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THE PROBLEM OF MOUNTAIN LION CONTROL IN CALIFORNIA.

(With five photographs.)

By JAY BRUCE, State Lion Hunter.

The mountain lion, also called puma, panther, and cougar, is the only predatory animal in California which is apparently of no economic benefit to the human race. Even the wildcat and coyote generally do more good than harm by preying principally upon rats, mice, gophers, ground squirrels and jackrabbits, thus helping to keep these pests under control. Although both wildcats and coyotes, especially the latter, cause considerable losses among sheep on the ranges and also occa-

sionally kill deer under favorable conditions, only a comparatively small number of these animals develop into confirmed killers of stock or deer. Furthermore, both wildcats and coyotes produce furs which are a source of revenue to a considerable number of people who live in the mountains and depend upon trapping as a means of income during the winter months.

On the other hand, the mountain lion is of practically no value as a fur bearer, game animal, or source of food, but is simply a liability

Fig. 1. A 160-pound lion hanging from a digger pine, out of which the lion was shot.

which probably costs the state a thousand dollars a year in deer meat alone to support each member of its lion population, or at the rate of $15,000 to maintain each lion during its natural existence.

INFORMATION SECURED BY PAYMENT OF BOUNTIES.

Practically nothing was definitely known about the lion situation in California prior to October, 1907, when the Fish and Game Commission began paying a bounty of $20 each for the killing of lions. Until then there was no reliable way of securing information. While the bounties

paid on 4350 lions during the last sixteen years have cost the state approximately $96,000, the information secured through this expenditure has alone been worth all it has cost, and the only way such information could have been secured was by the payment of bounties sufficient to encourage persons who killed lions to furnish the information necessary to secure such bounties.

DISTRIBUTION OF LIONS IN CALIFORNIA.

Much can be learned about the lion situation in California by an examination and study of these claims for bounties. For instance, we learn from this source of information that lions do not habitually range from the lower foothills to the crest of the highest mountain ranges, but that their normal range is confined to the areas which produce the varieties of ceanothus commonly called "deer brush," in which deer and stock feed principally. On the western slope of the Sierra Nevada from Fresno County north to Mount Shasta, this area can be described as that lying between 3000 feet and 5000 feet elevation, as measured on the divides between streams. The same elevations will apply to the lion country in the northern Coast Range from Mount St. Helena north to the Oregon line. In the Mount Hamilton range, the Gabilan range, Santa Cruz Mountains and San Lucia range, lions are found where the ridges are at least 3000 feet above sea level, while in the southern Sierra Nevada and mountains south of the Tehachapi the higher edge of the lion's normal range extends in places up to 7500 feet, at which elevation we find the same vegetation as at 5000 feet elevation farther north. A very small percentage of the 4350 lions taken during the last sixteen years have been taken outside of the above described area.

ESTIMATED LION POPULATION OF THE STATE.

By the application of this data it is not only possible to determine the exact areas inhabited by lions, but it is also possible to make a reasonably accurate estimate of the lion population of the state and to determine whether lions are increasing or decreasing from year to year. Mr. J. S. Hunter, assistant executive officer of the Fish and Game Commission, did make such an estimate, based on conditions existing in 1919, when the writer was employed by the Commission to hunt lions. About the same time the writer made an entirely separate and independent estimate, based upon density of population, and allowed an average of one lion to each township in the actual area of distribution. This was in accord with observations made while traveling for some 12,000 miles over the mountains of California hunting and trailing lions, and bagging, up to that time, about 125 lions. According to Mr. Hunter's estimate, the lion population in 1919 was 575 lions, while that made by the writer was 600 lions. It is interesting to note that these two estimates practically agreed, although determined by different methods.

THE INDICATED REDUCTION IN THE LION POPULATION.

In the interval between January 1, 1919, and June 30, 1924, the writer has taken 165 lions, or an average of 30 lions a year. In addi-

tion, a considerable number of lions have been taken by stockmen and others in the mountains, who started their dogs with the writer's trained lion hounds. While hunting for the Commission, it has always been my practice to encourage the killing of lions by these men who are continually riding the ranges in the lion country, and thus, in the course of their regular duties, often have unusual opportunities to take lions, if provided with a trained dog.

Because of this increase in kill, the lion population should have been reduced by at least 100 lions since the last estimate was made. This would bring the population down to about 475 lions at the present time, which, according to area of normal range, should be distributed about as follows: Sierra Nevada ranges, confined to a comparatively straight belt averaging about fifteen miles wide between Tehachapi Mountains and Mount Shasta, 160 lions; northern Coast Range from Mount St. Helena north to the Oregon line, an area lying between elevations of 3000 and 5000 feet, and most numerous in the pine-timbered area between the Sacramento Valley and the Redwood belt, 125 lions; Mount Hamilton and Gabilan range from Mount Hamilton south to northern San Luis Obispo County highest area, 40 lions; Santa Cruz Mountain highest area, 10 lions; San Lucia range from Carmel River south to the northern San Luis Obispo County line, elevations above 3000 feet, 40 lions; southern California from Santa Maria River southerly through San Rafael, Tehachapi, Sierra Madre, San Bernardino and San Jacinto mountains, elevations between 3000 feet and 7500 feet, 100 lions; total, 475 lions.

LIONS IN RELATION TO GAME REFUGES.

Eighteen state game refuges and part of three national parks are situated within the area inhabited by lions. Since the principal object in establishing game refuges is to furnish a harbor of safety during the open season for a sufficient breeding stock of male deer, no hunting, except for predatory animals, is allowed in these areas at any time. Most of these refuges are ideally situated for the purpose intended, but they will never be entirely effective until the U. S. Forest Service can be persuaded to prohibit stock grazing. Deer will accumulate to the limit of food supply in these refuges where they are not harassed at any time of the year, and, as the deer increase, lions are attracted. Because the lion's instinct is to kill at every opportunity, even though fully fed, the most damage will be done where deer are most numerous. Consequently, lions must be eliminated from these refuges if they are to be of any benefit.

Although in the actual area of distribution we find an average of about one lion for each township, and the average game refuge comprises about two or three townships and may harbor only two or three lions continuously, still nine or ten lions may be making most of their kills within the refuge where deer are most numerous. Although lions do not roam at random for great distances while in search of prey, each one does travel a definite beat, which is usually in the form of a loop 25 or 30 miles around and encompasses about 100 square miles. Therefore, lions which range part of the time in the areas which adjoin a game refuge, may be passing through the refuge on every trip around

their beat, which is usually every four or five days, and make most of their kills within the refuge where deer are most numerous. Consequently, in order to eliminate the lions from refuges, it is necessary to hunt these adjoining areas as well as the territory within the boundaries of the refuge.

HOW LIONS CAPTURE DEER.

The lion is a persistent hunter, often traveling 25 or 30 miles over rough country in 10 or 12 hours. When a deer is discovered by the prowling lion, the big cat approaches the quarry by stealthily moving from cover to cover, sometimes waiting for several minutes behind a tree, bush or rock until the deer moves behind another object. The deer is often thus stalked for several hundred feet before the lion approaches within striking distance. Usually when within 40 or 50 feet of his prospective victim, the lion makes a final charge and strikes it down by sheer force of onslaught, then kills it by disembowelment. Every action of a hunting lion is recorded by the tracks made in soft snow, consequently an observing person can accurately read the life history of these animals by trailing them when snow is on the ground. I, myself, have trailed lions for probably a thousand miles under such conditions, but I have never found any evidence that lions lie in wait on the limbs of trees in order to capture prey. However, a lion, while resting after a long trip, will occasionally scent a passing deer and sneak from its bedding place in search of the quarry, but they do not habitually lie in wait, except for a few minutes while making a stalk. Even then, while waiting behind the cover of tree or rock until the deer moves behind some other cover, the lion exhibits its impatience by continually changing the position of its front paws, as is evidenced by the number of tracks made in such places. There is no evidence that it lashes its tail.

By nature, the lion is restless rather than patient. It is not uncommon for a male lion to leave a fresh kill after one feed and make a 25- or 30-mile trip around its beat in search of another victim. Evidence of wanton killing by a lion was discovered when, in March, 1922, while hunting in company with Ed Garrett and Deputy James Poe near the junction of Panther Creek and the North Fork of the Mokelumne River, we found the carcasses of twelve deer that had been killed in as many days by one male lion. Nearly all of these kills were within sight of an old water ditch which the lion had been following for about two miles. This lion's tracks were first discovered by us about eight miles west of Panther Creek and followed to the place where the twelve kills were found. Our camp was then moved to this place and the next day, while trailing this lion twelve miles farther east, we discovered another kill which the lion had also abandoned after taking one feed, as I killed him that evening five miles farther on.

THE LION IN NATURAL HABITAT IS A SILENT ANIMAL.

Although I have several times heard lions in captivity utter sounds which resemble a hoarse whistle, I have never heard this sound uttered by wild lions in their natural habitat. The sound uttered by captive lions resembles more nearly that uttered by a red-tailed hawk and by

no stretch of the imagination could it be described as a "hair-raising, blood-curdling scream." This would more accurately describe the wails of the coyote. While spending more than thirty years in the lion country, hunting lions almost continuously during the last five years in nearly every part of California, trailing down and bagging 196 lions, I have never heard one scream uttered by a lion. In the nature of this big cat, whose very existence depends upon his ability to surprise the wariest animals, silence and stealth are developed to the highest degree.

BREEDING HABITS.

The adult mountain lion is normally a solitary animal and does not travel in bands or even in pairs except during the mating period, which may occur at any time of the year. Unlike most other wild animals, lions do not all breed at the same season. Therefore, the lioness seeks

FIG. 2. A 155-pound lion where picked up at the base of a bluff over which he rolled when shot from a tree.

the mate and when doing so she instinctively follows the prominent ridges which are used principally by the male lion, who, in order to disclose his beat to the lioness, leaves at intervals along his beat, marks made by digging with his forepaws in the leaves near the base of a tree or in rotten wood near an old log. These marks are all alike and, when once learned, can not be mistaken for anything else. When the seeking lioness discovers one of these marks she lingers near, leaving only long enough to make a kill and feed. When the male lion comes by on his next trip, which may be from one to three days later, he discovers by his sense of smell that a mate is near and in turn seeks her. Several times I have trailed a lioness onto a high ridge traveled by the lion and found a maze of tracks there indicating that both lions had spent considerable time searching for each other. Tracks were so numerous that the dogs were confused and it was necessary to circle at a distance of half a mile to find the outgoing trail, which showed that the lion and lioness had left the place together.

MALE LIONS FIGHT TO DEATH OVER MATE.

Occasionally two adult male lions are using the same beat, in which case there may be a battle between the two over a lioness. Conclusive evidence that two male lions battled to the death for the favor of a lioness was discovered by Joseph Dixon, of the California Museum of Vertebrate Zoology, and myself while hunting in Sequoia National Park, January 25, 1924. On that date we bagged a 145-pound male lion which showed evidence of having engaged in a desperate battle a few days previously. (See Fig. 4.) Two toes were missing from the lion's left forepaw and his head, neck and shoulders had been severely bitten and clawed. While we were proceeding along the road from Marble Fork bridge to Colony Mill, later the same day, we found the three-day-old tracks of the wounded lion which were identified by the missing toe marks. We back-tracked this lion for about a mile and a half where we discovered the two-day-old tracks of a smaller male lion.

FIG. 3. Examining tracks of mountain lion in road. Often this proves a useful way of locating lions.

After tracking the latter about one-half mile down the mountain side, we found his dead carcass. Though the dead lion bore severe wounds on his head, neck and one hip, he had apparently died from infection of the terrible lacerations in both front legs. The larger lion had probably intruded after the lioness had accepted the attentions of the smaller one and the latter, although mortally wounded, had apparently been the victor as the larger lion had left the scene of the combat and failed to return, while the lioness had faithfully lingered for two days near her mate's dead body, deserting it only when she heard the hounds approaching.

NUMBER OF KITTENS BORN AT ONE TIME.

The lioness usually gives birth to two or three kittens at a time, although sometimes only one and, occasionally, four are born in a litter. However, because of many females not finding a mate at every period,

the annual increase probably averages about one kitten to each adult female.

LOCATION OF LAIR FOR YOUNG.

Lions have no lair except in the case of the female when the young are to be born. Then it is merely a bed usually at the base of some bluff of rocks or in thick brush which furnishes a hiding place for the kittens while they are small. But the lioness herself seldom enters a den or cave even though such places are available. In Tulare County, in February, 1924, I captured a litter of four kittens not more than ten days old. They were in a bed which the lioness had established between the base of a leaning rock and a laurel bush. The bed was within 100 feet of the entrance of Clough's Cave, which extends for several hundred feet into a limestone dike. There were also a dozen or more smaller caves within a hundred feet, but still the lioness refused to seek the shelter of these caves. When discovered, she stood over the kittens and held three dogs at bay until I approached to within thirty feet. Then she deserted the kittens, fled to a tree and was shot. If these kittens had been older they would surely have sought refuge in some of the numerous caves as was done by three kittens which I captured in Placer County in August, 1923. In the latter instance, the three kittens, upon hearing the hounds, fled to a hiding place in a crack which extended for eight or ten feet back into the face of the bluff of rocks. It was necessary to watch this place for three days before they left their refuge and were cut off from retreat.

DEVELOPMENT AND SIZE OF LIONS.

When lion kittens are about five or six weeks old they weigh from six to eight pounds each and are able to follow the mother for short distances. When about eight weeks old they begin to eat meat and from that time on the mother leads them from one kill to another, leaving the kittens to devour one kill while she hunts for another victim, for the lioness must accept the entire burden of caring for the young. Usually, the kittens accompany the mother until they are about one year old, at which time the male kitten will be as large as its mother.

When fully matured, the male lion weighs from 120 pounds to 160 pounds, the average weight being about 140 pounds, and measures from 6½ feet to 7½ feet from tip of nose to tip of tail. The female weighs from 80 pounds to 105 pounds and measures from 6 feet to 6 feet 8 inches from tip to tip. The skin from a 7-foot lion will measure 9 feet when stretched and that is why we occasionally read of a 9-foot lion. The largest lion of 196 which I, myself, have taken, measured 7 feet, 3½ inches and weighed 160 pounds, but I will concede a possible 7 feet, 6 inches as the maximum length for the California lion.

POSSIBILITY OF ATTACK BY LIONS ON HUMANS.

Although the lion preys upon every other animal in California, so far as I can find, there is no authentic record of a normal mountain lion having voluntarily attacked a human being. I do not believe there is any danger of an attack on an adult human. In the case of the lioness which attacked the school teacher and child near Morgan Hill several

years ago, the lioness was undoubtedy infected with rabies as both of the victims died from that disease. However, I believe there is a possibility of the lion attacking a small child when it is unprotected. All stories of lions having trailed human beings are, in my opinion, misleading. Some of these stories are probably manufactured by persons who wish to give the impression that they have had a narrow escape from some dangerous animal. Other such stories are told in good faith by timid people who believe that as soon as darkness falls in the mountains dangerous wild animals are lurking behind every bush. When such persons are obliged to travel a mountain trail after dark they recall every lion story that they have ever heard; then as some small animal or bird moves in a nearby bush they become panic stricken, imagine they are being followed by mountain lions and are in great danger of being attacked.

Again, such stories are sometimes told by veteran mountaineers, who should know better but are actually ignorant of the habits of the mountain lion. They usually base these stories on the fact that they have found fresh tracks of lions in the morning on trails that they themselves had traveled after darkness on the night before. Upon such discovery, they immediately assume that the lion was following them, watching for an opportunity to attack. In all such instances the lion is merely following his beat.

ACTUAL DANGERS OF LION HUNTING.

While there is some danger connected with lion hunting operations, there is not much chance of being actually injured by the lion, although on one occasion a large male lion which had been twice shot with a small calibre revolver actually did spring out of the tree at me and very nearly landed on my head. Also, I have several times had narrow escapes from injury while defending my dogs when they were fighting a wounded lion. A wounded lion, forced to defend, will fight desperately to the last. In such cases he usually turns over on his back, seizes his enemy with his forepaws, and while holding thus, rakes with his hind feet and bites with his powerful teeth. However, practically all such risks to hunter and dogs can usually be avoided by first tying the dogs and then making a careful shot. Consequently, so far as the lion itself is concerned, there usually need be no danger to the hunter. In fact, there is much greater danger of falling and breaking one's leg while rushing after the dogs over rough brush-covered country. I have been much more impressed with the danger of losing the sight of both eyes from having them pierced by sharp limbs while hurriedly making my way through dense thickets of brush. This danger has been brought home to me by the experience of having injured both eyes in this way and being compelled to stop for several minutes before I could see well enough to continue the chase. Being alone and blinded in rough, unknown country, miles from traveled roads or trails, especially in stormy weather, is not a pleasant situation to contemplate. However, the hunter learns to anticipate and avoid many of these dangers. The danger of accidentally shooting oneself during the chase may be eliminated by not loading the gun until actually ready to shoot the game.

METHODS OF TAKING LIONS.

Although a lion is occasionally seen and shot by deer hunters or stockmen, stalking or still hunting is very seldom successful because the lion himself is a still hunter, and being endowed by nature with the keenest senses of sight, smell and hearing, with paws cushioned to allow him to pass noiselessly over rocks, leaves and earth, the instinct and ability to conceal himself behind the slightest possible cover or to remain motionless to avoid detection and always on the alert to surprise his quarry, it is not surprising that he is seldom seen by humans. In fact, many mountaineers spend a lifetime in lion country and never even get a glimpse of a lion. In all my own hunting experience, I have seen only one lion walking around in the woods, and that one was a 30-pound kitten 300 yards away, and the 149th lion that I had killed. Further-

FIG. 4. After the battle. At the left, a 145-pound survivor; a 104-pound male, killed by the lion at the left, and the 80-pound lioness over whom the males fought. Sequoia National Park, January 25, 1924. Photograph by Joseph Dixon.

more, in every instance that I have investigated when lions were reported seen, I have found that some other animal was mistaken for a lion.

Poisoning. Poison is sometimes used by stockmen and ranchers to rid the range of a stock-killing lion. The usual method is to place strychnine in the flesh of the kills made by the lion. Poisoning is only occasionally successful, as many stock-killing lions will not take a second feed from any kill, and, in the meantime, many valuable fur-bearing animals are destroyed; also valuable stock dogs or hunting dogs are often killed by eating of the poisoned carcass. In my opinion the poisoning method is wholly objectionable from every point of view, and is unnecessary, as, in every case where poisoning is effective in taking a lion, traps can be used with equal success and with less hazard

to other animals. When the traps are removed, the danger to other animals ceases, while it is almost impossible to remove every trace of poison, as was demonstrated in one case by Alonzo A. Davis of Sisquoc, California, who put poison in the carcass of a calf which had been killed by a lion. After securing the lion, Mr. Davis gathered up every piece that he could find of the poisoned bait and thoroughly burned it all. Nevertheless, more than a year later, near the place where the poison was used, he lost two valuable stock dogs which apparently died from eating some fragment of the poisoned bait that had been carried into the brush by rats or mice.

While practically every fur-bearing animal in California will feed on carcasses of dead animals whenever possible, still most of the carcasses of stock killed on the mountain ranges by lions and coyotes are devoured by bear, which fact often causes the bear to be wrongfully accused of killing the stock.

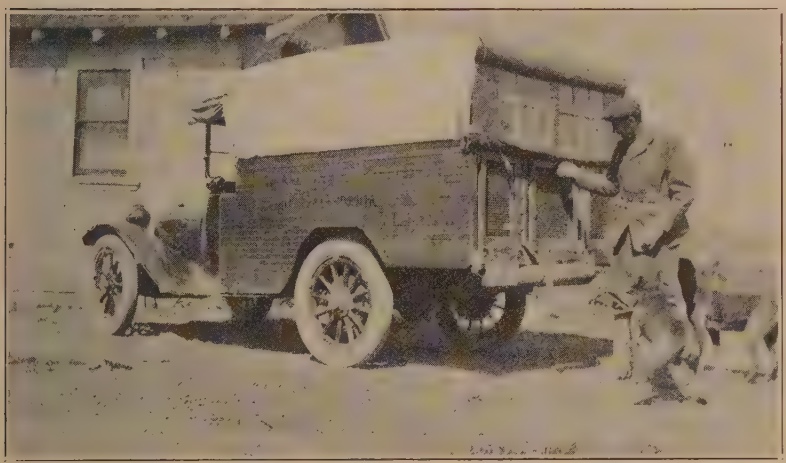


FIG. 5. Loading the dogs preparatory to a trip. Transportation and housing is furnished by a well equipped automobile.

While I was hunting lions in El Dorado County in 1922, in company with Mr. Frank Newbert, we were informed two lions had killed 100 sheep within twenty-five days, at the head of Alder Creek. Mr. Newbert and I arrived at this range about two days after the sheep had been moved out, but a cattle man by the name of Johnson took us to where one lion had killed a sheep about three days before. We could plainly see by the tracks that the lion had killed the sheep and dragged it for about a half mile and hidden it in a thicket of fir saplings. We found the remains of several sheep near this thicket and all of them had been devoured by bears, only the hide and bones remaining. We trailed this lion, which was a very large male, for about a mile and then found the fresh track of a lioness, which we followed until 2 o'clock in the afternoon, when we found where the carcass of a sheep had been dragged across the flat; we then followed the drag for about 200 feet and found the kill in a thicket of fir trees. This sheep had apparently been killed

about 9 o'clock the evening before and two bears had already found the carcass, devoured part of it and then bedded down near by, leaving only when they heard the hound baying on the lion trial. The bears had destroyed the lion tracks and scent around the carcass, and it was necessary to circle at a distance of a hundred feet to again find the lion tracks, which we followed unsuccessfully until dark. Early the next morning we returned to the kill in order to get her fresh tracks, if the lioness had returned to the kill. The lioness had not returned, but two bears had been there and devoured the remains of the sheep. I called Mr. Newbert's attention to the fact that all the evidence around the kill had indicated that the bear had killed the sheep. We then back-tracked the drag for about three hundred feet to the place where the sheep was killed. Then we could plainly see the tracks made by the lioness when she rushed over and struck down the sheep, thus proving the lioness the slayer. This lioness had apparently killed this strong sheep about 9 o'clock in the evening, dragged it to cover, taken a feed, and then left the place with no intention of returning for another feed, for I tracked her for three days and killed her twenty-five miles from this place. During the next few days I tracked the male lion around his beat, which at one place was twenty-five miles from the sheep range. When I killed him he had almost reached the sheep range again.

Trapping. The use of bait or scent to attract lions to traps is usually not effective. While such lures will attract most other animals, the lion usually pays no attention to them but prefers to kill his own food. Finding the lion's own kills and setting traps around them is the better method and that most often used by trappers. However, the most effective method of trapping lions is setting traps on their regular beat. A narrow place in the trail used by the lion should be selected and several traps set at intervals along the trail. A limb or trunk of a sapling should be placed across the trail, about two feet above each trap, to prevent deer from stepping into them. Deer will spring over such an obstruction while lions will pass underneath them. William Mayers of Paskenta, California, trapped eleven lions in this way during two winters. Ten of them were females and one was a half-grown female that was still following its mother. The fact that these eleven lions were all traveling the same beat and were all caught in the same place can be understood by anyone who has studied the habits of animals, for every animal, whether wild or domestic, will follow a known beat or way when traveling over country where they have been before. All these lions were evidently descendants of some lioness that had used this beat regularly and who probably led two or three litters of kittens around this beat while they were growing up. The young lions when grown probably selected their regular beat twelve or fifteen miles away, but every few weeks made a trip back to the range where they were raised, and in doing so traveled over the route which they already knew. Naturally several of these kittens were females, and in turn each led several kittens over the same beat when visiting their old range. Thus in six or seven years three or four generations could be making occasional trips over exactly the same beat. These lions were all caught in the bottom of a canyon, which explains why no adult males were

taken, for the adult male lion habitually travels the tops of the main ridges and well defined spurs.

Trailing with dogs. By far the most reliable method of taking lions is by trailing and treeing them by the aid of trained dogs. Success by this method depends upon the ability of the hunter and dogs to follow the lion's old tracks for many miles. Therefore, the first-class lion dog must be a determined trailer and also a natural treeing dog. Not every dog has these qualifications, for many hounds, while good trailers, never learn to locate a treed lion, but will come back to the hunter when the scent is missed where the lion springs into the tree. Other dogs will locate the treed lion but fail to bark "treed," being content to sit for hours at the base of the tree without making a sound. Consequently the hunter is unable to locate the dog or lion unless conditions are such that he can trail them to the tree. The type of dog required by the professional lion hunter is one that will find tracks two days old and will never quit any lion trail of his own accord until he is completely prostrated. He will work a day-old trail for twenty-five miles over all kinds of country in the summer when the temperature is 95 degrees in the shade or swim swollen stream in the coldest winter weather; then with bruised and bleeding feet run down and tree the lion and hold it treed, or, if the cat jumps out, continue to tree it for twelve or fifteen hours, if necessary, until the hunter arrives. All of these qualifications of a first-class lion dog are combined in many foxhounds or a cross of foxhound and bloodhound, but in no other breed of dogs in existence.

EFFECTIVENESS OF HUNTING WITH DOGS COMPARED TO USE OF TRAPS AND POISON.

As an illustration of the effectiveness of hunting lions with dogs compared to use of traps and poison, I will state a few examples. During January, February, and part of March, 1917, a number of hogs and goats were killed by a large male lion on two ranches a few miles east of Mariposa. On one occasion, nine hogs were killed during one night by this lion, which had consistently avoided traps and poison by refusing to feed twice on any kill. However, I bagged this lion within two hours with the aid of one dog. In August, 1919, near Kinsley, Mariposa County, with four days of hunting, I bagged two stock-killing lions that had evaded traps and poison for two months. A third example was when, in one hour of hunting with the aid of two dogs, I bagged a large male lion which had killed 300 goats for Charles Ralph of Tuolumne. This lion, living continuously on the goat range, had evaded traps, poison and still hunting for a year, and Ralph had appealed for aid. Still another example was in Tulare County where Britton and Loverin of Three Rivers had lost a number of calves and several larger cattle by the depredations of a large male lion. Most of these kills were found but it was noted that the lion had taken only one feed from each. As valuable stock dogs were being used continually on the range, it was deemed inadvisable to use trap or poison. With the aid of three dogs, I bagged this lion and three others within two weeks of hunting.

TRAINING DOGS FOR LION HUNTING.

Most dogs will not pay any attention to the odor of a lion or have any inclination to trail them until after having been present at the killing of one or more lions, for lions are not the natural quarry of the dog family. Indeed, very few dogs will eat the flesh of lions until after they become interested in hunting them. On the other hand, every dog is eager to run deer and rabbits, which are their natural prey.

A dog that will chase deer and other animals is of no use to a lion hunter, for the dog's energy must be entirely conserved for the lion chase. Also, a deer-chasing dog causes the hunter loss of time and energy. Consequently, the first consideration in training the young dog is to prevent him from running deer or other animals than lions. This can be best accomplished by leading the pup with a leash until the trained dogs tree a lion and then turning him loose at the tree when the quarry is shot, thus allowing the dog his first hunting experience on the game which the hunter desires him to trail.

After one or two such experiences, the pup can be turned loose with the trained dogs when a lion's fresh tracks are found. In the meantime, the young dog should be severely punished whenever he pays any attention to the tracks of other game. Under no circumstances should a deer ever be killed when the lion dogs are present or deer meat be had in camp or fed to the dogs. It is not difficult to interest a pup or start a young dog when the hunter uses trained dogs to trail and tree the lions. However, dogs may be trained to hunt lions without the aid of experienced dogs by working when there is several inches of snow on the ground, thus allowing the hunter to trail the lion until it is frightened from its bedding place. Then the young dogs should be turned loose on the lion's fresh tracks and urged to chase the lion until it is treed.

HUNTING REQUIRES FOUR DOGS.

The questing hound, while working out the average lion trail, which is from 18 to 30 hours old when found, will travel about 75 miles in 12 or 14 hours in order to advance 15 miles, the distance traveled by the lion. The feet of the lion-hunting dog are always subject to severe damage from sharp rocks and gravel. Therefore, he requires at least one day of complete rest for each day of work. Consequently, a lion hunter, in order to keep busy, requires at least four hounds, which should be used in pairs, each pair being allowed to rest on alternate days. Two hounds work out the average lion trail more efficiently than a larger number because there is less chance of them following a back trail through crowding or interference with each other.

CARE AND FEEDING OF DOGS.

In order to maintain hunting dogs in the best physical condition, it is necessary to feed and care for them systematically and scientifically. The only way that this can be accomplished is by having the dogs under control at all times by keeping them tied in temporary camp, or in a roomy pen when resting at headquarters, for a hound running loose is continually on the hunt for food and it is impossible for the hunter to properly feed his dog unless he knows just what they have been

eating. My dogs are fed every evening. Fresh raw meat is by far the best food for a working dog and my dogs are fed the lion carcass whenever practicable. But many times lions are killed long distances from camp and it is not practicable to carry the carcass for miles over rough, brushy country. In such cases, the dogs are given one feed from the freshly killed carcass. The hunter must always have plenty of scientifically prepared commercial food for use when meat can not be procured.

After each hunting trip, which is usually from fifteen to twenty days duration, the dogs should be bathed or sprayed with a solution of water and sheep dip to eliminate woodticks and fleas.

TRANSPORTATION AND EQUIPMENT.

In order to carry on the lion hunting operations efficiently and to be able to respond quickly to reports from places where lions were doing damage, it was necessary to have a means of transportation which would be always available at a few minutes notice. This problem was solved by mounting a specially built camping body on a durable automobile chassis. The body was constructed so as to provide a reasonably comfortable shelter for hunter and dogs when on the road or in camp. A gasoline stove is used for cooking and food and utensils are packed in two boxes having special compartments which hold rations for one person for two weeks. These boxes can be slung on to a pack saddle when it is necessary to pack by horse into the lion country. They provide closet and table in camp and are always packed for transportation, which eliminates work and confusion of hurriedly gathering scattered equipment or of transferring articles of food piecemeal from auto to horse or *vice versa.*

EQUIPMENT FOR THE HUNT.

While on the actual hunt, it is advantageous to travel light, so all necessary equipment has been reduced to a minimum of weight. In place of the usual rifle or carbine to shoot the lion, I use a 38–40 revolver with a six-inch barrel, carried in a shoulder holster, which permits the use of both hands to protect the face from brush and to assist in climbing over rocks. Instead of the cumbersome skinning knife, I use a medium sized pocketknife with one skinning blade and one long, narrow blade for skinning feet and toes of lion. This knife, a small round whetstone, light scale, a five-foot steel tape, a compass, and extra cartridges are packed in a waterproof canvas bag. In an army bacon tin are packed a vest pocket camera, extra roll of films, a small vial of iodine, permanganate of potash, waterproof match box, sharp penknife, one yard of adhesive tape, also notebook and pencil for recording data. A lunch is always carried and, in some cases, rations sufficient for two days are carried in the event that it may be necessary to spend one night away from camp. All the above equipment, except revolver, is carried in a leather knapsack and, exclusive of food, weighs ten pounds.

COOPERATION.

After the first two years of hunting operations, which resulted in the taking of fifty-six lions, thereby demonstrating that this work could be done effectively when properly supported, the United States Forest

Service, game protective associations, stockmen, and mountain people generally began to take an interest in the work. Forest rangers and stockmen especially, on account of their riding often over trails in the lion country, are in a particularly favorable position to render assistance by watching for lion tracks and reporting same, and many lions have been taken as a result of following up such reports; also considerable time and expense has been saved through the willingness of stockmen to furnish accommodations for the hunter in their mountain camps, and to furnish, free of charge, their services and the use of their horses to pack equipment for hunting operations.

THE HUNT.

When commencing the actual hunt, I usually establish a base camp near some ranger station or mountain ranch which has telephone communication, then call up every forest ranger and stockman for miles around and inquire whether lion tracks have been noticed and, if so, at what places. I also request that they watch carefully for lion signs and report to me every day. By the use of a map and the information thus secured, it is often possible for me to determine a lion's beat while I am camped miles away and, on the first day of hunting in a country unknown to me, to bag the only lion within an area of 100 square miles. I start from camp at 4 a.m. in summer and 6 a.m. in winter, and quite often I have returned to camp from a twelve- or fifteen-mile hunt during the forenoon, found a telephone message awaiting me, packed up equipment, driven fifteen or twenty miles to the source of the report and bagged one or more lions before nightfall. When I hear of lion tracks being seen several times at certain places, I assume that that particular place is part of the lion's regular beat, and I start the hunt from there each morning until the lion's fresh tracks are found, which is usually within three days—quite often the first day—depending upon when the lion last passed, for a lion usually covers its beat every four or five days.

Because lions usually hunt during the night, it is not desirable for the hunter to follow the same route twice in one day, when it is necessary to return to the home camp each night. Instead, a loop should be followed, as this allows the hunter to cross the lion's beat at two or more places during one day, thus providing several chances to find the lion's fresh tracks. However, the best plan is to hunt across country for a distance of twelve to twenty miles, stopping on alternate nights at the opposite ends of the trip. Thus the beats of several lions may be crossed each day and the hunter can return to the camp nearest when the lion is bagged. Usually, the hunter can secure accommodations at a ranch or stockmen's camp, which eliminates the discomfort of lying out by a campfire. When driving through lion country, I always watch the road carefully and have several times noticed lion tracks in the dusty road, parked the auto, started the dogs on the tracks, and bagged one or more lions, sometimes trailing ten or twelve miles and not returning to the auto until the next day.

After a lion's tracks are found and the chase is on, the hunter must keep as close as possible to the dogs. At all times during the chase he should watch the ground carefully for any sign which would explain the difficulty if the dogs should become confused, for often the lion

will scent a deer and turn off his beat for several hundred feet; then, if the deer escapes, the lion will double back on his own trail and continue his regular route. In such cases, considerable time will be saved by calling the dogs back to where the lion's back track was first noticed and then following a loop until the forward trail is again found. On the average trail followed it is necessary for the hunter to assist the dogs about a dozen times during ten or twelve hours of trailing. Often the lion tracks and scent are obliterated by cattle stampeding over them. Then the dogs are helpless and, if left to their own resources, they will work at such a place for several hours without making any progress. In such cases, the hunter should immediately call off the dogs, take them away for a half mile, if necessary, then follow a loop with a radius of a half mile or so around the place where the lion's tracks were destroyed until the tracks are again found.

Quite often a wise old cat, when hard pressed by the dogs, will run for several hundred feet past the tree he intends to climb, then double back over his own track and spring high into the tree and hide among the branches. This ruse confuses the dogs, who, following the fresh scent on the ground, rush past the treed lion only to come to a bewildering lapse where the lion doubled back. Then the hunter must find the treed lion, and I have twice hunted for three hours before the lion was discovered.

It is usually not difficult to shoot a treed lion, this most often being done at close range. However, it is advisable to tie the dogs whenever practicable, thus preventing them from being struck by the dying lion when it falls from the tree, or from attacking a wounded lion and being killed or injured in the struggle. However, it is not always practicable to tie the dogs as in a case where the dogs are tired and footsore and the lion is treed in a situation such as rough, brushy mountainside or river rim, which would render it difficult to tree the lion again if it should jump out of the tree while the hunter is tying the dogs. Then the hunter should cautiously approach the tree, make a careful shot, and be prepared to defend the dogs in an emergency.

A BIOLOGICAL AND PHYSIOGRAPHIC SURVEY OF CALIFORNIA LAKES AND STREAMS.

Its Purpose, Scope and Significance in Relation to Their Stocking With Native or Introduced Species of Trout and Other Game Fishes.

(With four photographs by the author.)

By Geo. A. Coleman.

The Department of Fish Culture of the California Fish and Game Commission, realizing the importance of accurate information concerning the conditions of existence of the trout and other game fishes in our mountain lakes and streams, has inaugurated a survey for the purpose of obtaining first-hand information concerning these conditions. While the investigations will be conducted in a thoroughly scientific manner, the main object is not to make a great collection of the species of aquatic plants, animals and insects occurring in these lakes and streams, many

of which are unnamed and new to scientific literature, but rather to obtain all the data possible on the abundance, life histories and habits of the comparatively few species which are directly concerned as food, or in the maintenance of a proper supply of food for the fish.

Any scheme, however, which would not include a study of all the conditions necessary for the existence of the fish, would be inadequate, since our most beautiful, healthiest and gamiest of trout are the result not only of an endless succession of plant, crustacean, molluscan and insect life, but also of certain physical conditions of the waters which they inhabit, which are favorable to their existence and complete development.

The trout feed upon the smaller crustaceans and molluscs and larger aquatic insects and their larvae, with a minimum of plant food. The crustaceans, molluscs and aquatic insects are in turn dependent upon a plentiful supply of the microscopic plant and animal life in the waters

FIG. 6. The pack train ready for the start over Baxter Pass, 13,150 feet elevation, preparatory to biological studies of Baxter Lakes.

which they inhabit, which we lump together under the general term of plankton, which is, however, divided into two great branches, viz: the phyto-plankton, or microscopic plant life (fresh water algae), and the zoo-plankton, or microscopic animal life (protozoa, infusoria, etc.).

The fish, as well as all other forms of life, are dependent upon the physical conditions in the lake or stream, viz: the temperature, turbidity, light penetration, depth of water, direction and strength of the currents, character of the bottom, etc. All have their bearing, and as every fisherman knows, all of those external conditions which we designate as "the weather" have a direct influence upon the movements and behavior of the fish. All animals react to changes of temperature very quickly and both marine and fresh water fishes will recognize a difference as slight as 0.2° C. The larval stages of aquatic insects are largely governed in their development by the temperature of the water in which they live. Stream temperatures usually vary only in cross-section from

the middle of the stream to the shallow water at the edge and with a daily fluctuation according to atmospheric conditions, while in the lakes it depends upon the elevation, size and depth. In a lake of any size there is a zone of circulation at the surface for a few feet in depth which is governed by the atmospheric temperature and the wind. If it be a shallow lake the circulation is general and extends to the bottom and there is therefore an even temperature throughout the lake. This may also be the case with deeper lakes in the colder months of the year. In very deep lakes, however, the hot summer sun warms the surface water, setting up a superficial circulation for a few feet in depth, which is, therefore, thoroughly aerated, while the bottom waters remain stagnant until cold weather corrects this condition by starting a circulation in the deeper waters.

The migration and distribution of the animal life and the growth of the plant life are also greatly influenced by the light penetration, since light has a marked effect upon all life processes. For example, the free swimming crustaceans usually accumulate near the surface at night and migrate to deep water during the daytime.

The character of the bottom is perhaps the greatest single factor in determining what species of plants, animals and insects may live and breed in any stream or lake. Sandy-bottomed streams, with a sluggish current, have a plentiful supply of such forms of insects as live or breed in the fine silt and sand of the bottom and shores and of the larger rooted aquatic plants, together with such forms of animal life as cling to them for protection. If, however, such a stream has a swift current, the plants can not gain a foothold and the stream may, therefore, be barren of nearly all forms of life. On the other hand, some of our swiftest mountain streams, with rocky bottoms, have the richest fauna of all species of aquatic plants and insects, as pools and eddies are formed in which there is gradually accumulated soil and plants, even the rocks becoming covered with certain species of algae. The rocks also afford shelter for molluscs, crustacea and insect larvae and hiding places for the young trout.

There are thousands of lakes in the high Sierras, from 10,000 to 13,000 feet elevation, which are barren of all kinds of plant and animal life, except the very lowest forms of algae, a few species of crustacea, molluscs and aquatic insects, simply for the reason that, their source being the eternal snows and glaciers, only such forms have reached them as have been carried by the wind, on the feet of birds, or such winged insects as might survive these high altitudes. One of the most interesting and instructive studies in the world may be had by climbing to the summit of any of the one hundred or more peaks in the Sierras, above 10,000 feet altitude, and making careful observations on the disintegration of the various forms of granite and other rocks as the snow and ice melts, then following the carrying of this material by the streams and rivulets formed by the melting snow and ice down until it is deposited in the deep holes in the lakes at or above timberline, thus laying the foundation soil for the support of the algae and larger aquatic vegetation which are necessary for the support of the animal life. The very genesis of life on the earth can be seen and studied here any day from the beginning of spring, June or July, at these high altitudes, to the coming of the winter snows in October or November—

and what a revelation it is! Many living algae, spores of plants and lower forms of animal life are found in the snow above any lakes or streams, some forms being so resistant to heat and cold that they may be dried up in the summer sun, blown for miles by the wind and lodged in some snowbank, on some bare rock, or on the bottom of a dried up lake, there to lie under tons of winter snows until revived and started upon a new life cycle by the returning summer sun.

All of this aquatic life is dependent upon an adequate supply of oxygen, obtainable from the dissolved oxygen in the water which is inhabited. The principal source of this dissolved oxygen in the lake waters is from the air held in solution and from the process of photosynthesis which is continually taking place in the green plants in the water; a process in which the algae are mostly concerned since they contain chlorophyll, a substance by virtue of which they have the power of food building, in which water and carbon dioxide are united to form

FIG. 7. Collecting plankton in Rae Lakes. A canvas boat is used.

starch and other carbohydrates, thus storing up energy for the plants. In this process the carbon dioxide given off by the animals in the process of respiration is absorbed by the plants, while oxygen is set free for the use of the animals in its dissolved form in the water. The decay of dead and dying vegetation in the water produces an excess of carbon dioxide and a diminution, or even a depletion of the oxygen to such an extent as may kill the fish as well as other forms of animal life. It is, therefore, necessary to maintain a proper balance between the living plant and animal life, having neither a superabundance or a lack of any element in order for the best success and the maintenance of a healthy condition of the fish.

In order to obtain the necessary facts and scientific data upon which to base our method of procedure in the case of each individual lake or stream, it is necessary to make these determinations at the lake or stream in question, where the plant and animal life may be studied while living in its natural environment, rather than in a far distant

laboratory with dried up specimens. Investigators, therefore, must carry complete equipment for this work:

First, a complete camping outfit—tents, cooking utensils, beds and bedding and food supplies for several weeks; pack and saddle animals, which during the past summer were limited to three pack mules and two saddle horses, well equipped.

The collecting paraphernalia and apparatus for scientific study may be described in detail and as to purpose as follows: A small folding canvas canoe which was found indispensable on the larger lakes for making soundings, collecting from deep water and for working plank-

FIG. 8. Making tests for dissolved oxygen and carbon dioxide in the waters of Rae Lakes in a chemical laboratory set up under a tree.

ton nets effectively. The plankton is collected by means of a series of plankton nets made of silk bolting cloth, varying in the size of the mesh from the very finest (No. 20) to the coarsest, which enables us to collect, strain from the water and sort all sizes of algae, crustacea and insect life, from the most minute microscopic forms to the larger crustacea and insects. For the examination of the material collected, a Leitz binocular research microscope, with objectives and eyepieces of wide range and the necessary accessories, all packed in a neat leather case for safe transportation, is provided. The chemical apparatus and

chemicals necessary for making the tests for dissolved oxygen and carbon dioxide are arranged in a small wooden case easily carried and set up for work. Several thermometers and a Tycos aneroid barometer, reading to 16,000-foot altitude, by 50-foot intervals, compensated for temperature and giving the pressure in inches and tenths and a Brunton compass for running lines and fixing the points of departure for the soundings, complete the field outfit. For keeping permanent records the Lefax loose leaf system is used, which allows all forms to be carried in one cover in the field and provides for subsequent indexing and filing away of all filled sheets for future reference.

A very important part of the work is the examination of the stomach contents of all fish caught, which gives the key to the food conditions

FIG. 9. Microscopic examination of plankton from Baxter Lakes. The microscope sits upon a fallen white pine.

at the time. The condition of the fish and quality of the flesh are also noted.

When the survey of a lake or stream is completed in this thorough manner we have reliable data from which to construct a physiographic sheet which will show at a glance the conditions existing in any lake or stream and which may be used as a guide in the planting of these lakes and streams with the proper plants, crustacea and insect life, a work which will be carried on simultaneously with the survey investigations. Later, when the proper food conditions have been established, it will also serve as a guide in the distribution of the trout fry from our several hatcheries. Finally, the records of all plantings of food and of fish may be kept together on one sheet and checked up from year to year as to the results we are getting.

Since the Rae Lakes have been set aside as a breeding ground for mountain rainbow, the work of the survey was begun here during the past summer. The results of this survey and others will be published from time to time, the first of the series probably appearing in the next number of CALIFORNIA FISH AND GAME.

A CLOSED SEASON NEEDED FOR FISHER, MARTEN AND WOLVERINE IN CALIFORNIA.

(With one diagram by the author.)

By JOSEPH DIXON, Economic Mammalogist, University of California, Museum of Vertebrate Zoology.

The writer has just finished compiling the catch of the licensed trappers of California for the years 1920 to 1924, inclusive. He finds that certain of our most valuable fur bearers are not only decreasing rapidly in numbers but have even now reached the danger point. This will be seen plainly by a study of the accompanying diagrams which show the numbers of these animals trapped during five successive years.

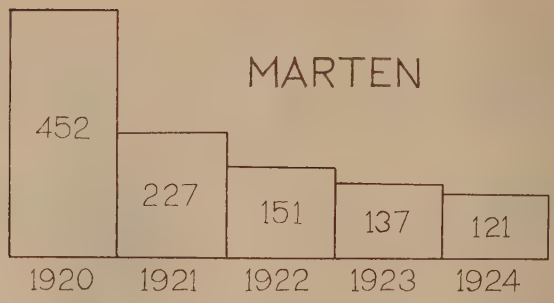
The number of martens caught and reported by the licensed trappers of California has dropped from 452 in 1920 to 121 in 1924. This is a decrease of 73 per cent during a period of five years.

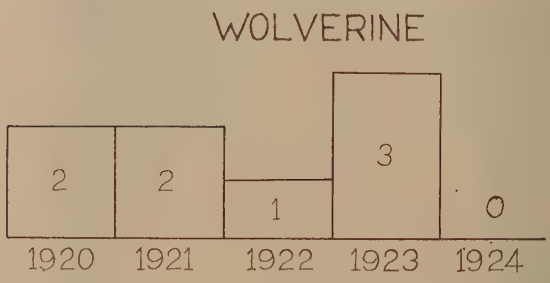
The wolverine never was an abundant or even a common species in California, at least during historic times. The trappers' reports show that during the four-year period, 1920–1923, inclusive, the catch averaged two per year for the entire state. Last season, 1924, not a single wolverine pelt was reported.

The number of fishers taken has also decreased, dropping from 102 in 1920 to 34 in 1924. This is a loss of 67 per cent in five years. The large catch of 34 fishers during 1924 was due to two trappers operating on the border of California's most famous national park. These men report having caught *nine* fishers during the one winter.

It is the author's belief that the accompanying diagrams represent truly the present status of the marten, wolverine and fisher in California. As these animals have become scarcer and more difficult to obtain, there has been a corresponding increase in prices offered for their pelts. *The falling off in the catch is not in this case due to low prices.* Furthermore, the reports of the licensed trappers show that most of the marten and fisher are caught by a few professional trappers. Thus in 1924 only fourteen trappers reported having trapped fisher, and a like number of trappers secured the entire catch of 121 marten that were taken that year. It is thus possible, by going over the reports of certain trappers who trap season after season in the same general locality, to gain a fair knowledge of the relative abundance of certain species of fur bearers in that territory.

The marten, wolverine and fisher are not numerous enough in California to cause any appreciable damage, either to game or to domestic stock. A study by the author of food found in the stomach of these animals has shown that they live largely on rodents, and hence are, from an economic standpoint, at the most only slightly injurious. What little damage they may do in destroying game is offset many times by the value of the pelts they produce.





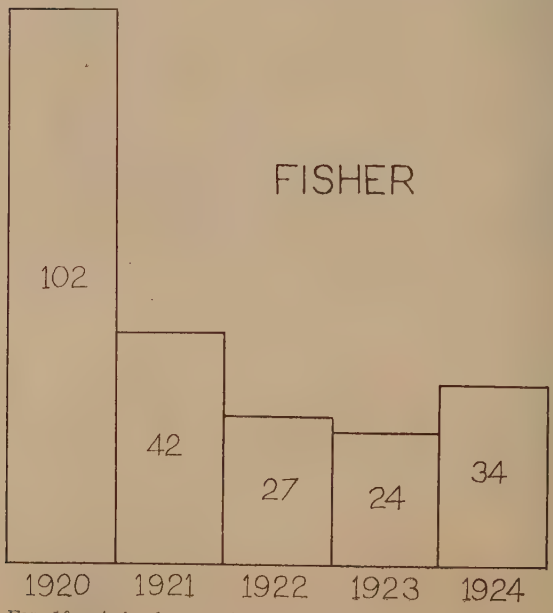


FIG. 10. Animals reported caught by licensed trappers of California, 1920-1924.

At the present rate of decrease, there will be no martens or fishers left in California within five years. (See diagrams showing decrease.)

Three courses of action are possible. We can do nothing and permit the fisher and the marten to go the way of the passenger pigeon. We can wait a few years longer, when the marten and fisher are practically gone, and then put on a long closed season, which will be necessary to bring them back. We can, best of all, put on a short closed season *now* and give these animals a chance before it is too late.

It has been the writer's experience, through personal contact with many of the trappers of California, that, where the facts have been presented fairly, the trappers themselves are among the first to favor adequate protection for fur bearers. It is believed that the trappers

FIG. 11. Ducks in Butte County, California, winter of 1923–1924. Photograph by George Thompson.

will be more willing to respect and support a short closed season now than they would a hopelessly long one later on. Since there are few, if any, game wardens in the territory where the marten and fisher are trapped in the winter, any legislation, to be effective, must have the backing and support of the trappers themselves.

The writer therefore strongly recommends to the Legislative Committee of the California Fish and Game Commission that marten, fisher and wolverine be given a three-year closed season in California, beginning October 15, 1925, or as soon thereafter as legislation can be secured.

Berkeley, California, December 1, 1924.

CALIFORNIA FISH AND GAME

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

February 7, 1925.

Conservation measures should be intelligent, effective and adequate. Note that the first requisite makes the educational method a necessity.

COMMISSION'S TWENTY-EIGHTH BIENNIAL REPORT ISSUED.

The twenty-eighth biennial report of the California Fish and Game Commission, covering the fiscal years, July 1, 1922, to June 30, 1924, made its appearance in a beautiful colored cover showing the rainbow trout, and with pages replete in data as to the accomplishments along the lines of fish and game conservation.

During the biennial period over 2700 arrests were made for violations of the fish and game laws, showing that the patrol service has been active. A record number of fish have been planted in the streams and lakes of the state—more than 56,500,000 trout and nearly 35,500,000 salmon. The fishcultural department has increased the fish resources of the state by the importation of a new stock of eastern brook trout, by two shipments of Mackinaw trout—the largest trout in North America, which were planted in Clear and Eagle lakes—and by supplies of cutthroat trout for planting in the north coast streams.

The marine fisheries have made almost a complete recovery since the post-war slump, the catch for the years 1922–23 amounting to the huge total of 387,615,506 pounds of fish. Valuable results are being obtained by the staff of scientists engaged in fishery research at the State Fisheries Laboratory at San Pedro. Methods of foretelling the catch and means of discovering depletion are being made possible through these investigations. An investigation of the purse seine fishing in southern California waters was brought to a conclusion and a report is ready for publication. No state or country is gathering as dependable statistics regarding marine fisheries as is California at the present time.

The past two years has seen the return of many salmon marked several years ago. A study of the scales of these fish made by Professor John O. Snyder of Stanford University has furnished much evidence as to the age and rate of growth. Furthermore, the parent-stream theory has been definitely proved. Fish hatched from eggs taken on the Sacramento, but liberated in the Klamath River, all returned, as far as known, to the Klamath River.

Special patrol and permanent boundary signs have helped to improve conditions on the state's twenty-eight game refuges.

Lectures, talks in schools, newspaper items, magazine articles, and educational work in summer resorts have featured the educational and publicity campaign. CALIFORNIA FISH AND GAME, the Commission's quarterly magazine, which has continued to furnish reliable information relative to conservation, is now in its tenth volume.

The situation confronting conservationists as a result of plans to build high dams near the mouths of streams is fully discussed, as are also other problems pertaining to the conservation of the state's natural resources.

A compilation showing the number of deputies, arrests, and finances in the various states gives a splendid opportunity for comparison. Considering the size of California, the force of deputies is shown to be too small and the expense of patrol far under that found necessary in other states.

KLAMATH RIVER MEASURE WINS BY 197,127.

Official figures show that the majority in favor of the Klamath River fish reserve which appeared on the November ballot was 197,127. Sacramento proved the banner county, going four to one in favor. Fresno and Los Angeles counties went two to one in favor. Several of the Sierran counties showed slight majorities against: Alpine, Mariposa and Sierra. San Francisco showed a majority of 6540 against, while Humboldt County, which was claimed to be solidly opposed to the measure, showed a majority of only 3034 against.

PATROL FORCE AUGMENTED.

Means has been found for increasing the patrol force. Popular demand for a larger force has been growing of late and the decision to increase the number of wardens comes at an auspicious time. A dozen additional wardens have been appointed, the larger proportion of whom have been assigned to the Los Angeles district office to help care for the needs of the section of the state which has increased so rapidly in population.

STATE VERSUS FEDERAL CONTROL OF GAME.

One of the outstanding points of discussion at the annual meeting of the Western Association of State Game Commissioners, which was held at Portland, Oregon, August 22–23, 1924, is the growing tendency on the part of the federal government to assume responsibilities which definitely belong to the state. Mr. D. H. Madsen, Game Commissioner of Utah, attacked the Game Refuge-Public Shooting Grounds bill and made a plea for championing state rights. From his viewpoint, no federal bureau can make an improvement on the conservation methods now being used by the various states. E. M. Bagley, an accredited delegate to the National Conference on Outdoor Recreation, advocated fighting any attempt to "turn over to the national government jurisdiction over any of those matters which properly fall within the jurisdiction of the several states and which are now being so well and efficiently administered and safeguarded by the fish and game departments in most of the states." His impressions of the conference were to the effect that those who favor federal domination are slowly preparing more and richer soil so that the sovereign states may gradually lose the strength to extricate themselves and their power to control and own fish and game may wane, shrivel and die.

Mr. R. G. Parvin, Game Commissioner of Colorado, also read a paper which ended with the following paragraph: "It is important that we use every practical means by providing refuge and breeding grounds for migratory birds; it is equally important that all game which the states hold in trust for the benefit of their citizens shall be used for the benefit of all their citizens and not for a favored few; but in our opinion it is far more important that the federal government concentrate its utmost power and all its available resources to the administration of those national and world affairs which shall assure to the citizens of our Republic continued enjoyment of all the rights and privileges guaranteed them by our constitution.

A set of resolutions advocating the passage of the Public Shooting Ground-Game Refuge bill failed to pass.

DEER KILLED BY LOCOMOTIVES.

That some deer are killed by trains on the American River route across the mountains has been known for some time. The animals fail to leave the beam of light made by the headlight and are caught by the engine. Engineers oftentimes do everything in their power to prevent such an accident, even to practically stopping the train. In spite of their care and efforts a toll is taken. A recent talk with one of these engineers revealed what is apparently the real cause for deer collecting on the right of way. According to this engineer, the salt water which drips from iced fruit cars makes a salt lick attractive to deer. If this be true, perhaps the solution of the problem lies in the creation of a number of salt licks more attractive to the deer than the chance salt licks on the right of way.

YOSEMITE FURNISHES SECOND LARGE TROUT.

Whether because of the drought or other conditions, Yosemite has produced two of the largest fish in many years. During the summer a Loch Leven trout, weighing within an ounce of 10 pounds, was secured, and on September 28th, Mr. Albert Skelton caught, in the Merced River, below the Pohono bridge, a 29½-inch German brown trout, which weighed 9 pounds and 3 ounces. Both of these large fish are to be placed on exhibition in the new Yosemite museum.

MODOC DEER DISEASE.

The disease which took a large toll of mule deer in Modoc County, reported in the last issue of CALIFORNIA FISH AND GAME, still remains somewhat of a mystery. At least four separate investigations were made by various persons. The Fish and Game Commission sent a special investigator. The State Veterinarian visited the area, as did also Dr. C. M. Tinsman and various sportsmen from Oregon. All agree that the poor water supply, owing to the drouth, was concerned. Many dead deer that were examined contained a stomach full of mud. Both sick and dead deer were found with serious head infections. These infections often seemed to involve the tongue, throat and upper teeth. In some

instances the infection could be traced from an upper molar to the optic nerve. The reports that the sick deer became blind were thus authenticated.

Apparently, the number of deer which met death was overestimated owing to the fact that the same dead deer were often counted by various parties. It is probable that no more died from disease than would have been killed had the forest been open to hunters. The disease seems to have been limited to a relatively small area, for deer in sections away from the dried-up springs continued in a healthy condition. A late report from Deputy French, who made four different investigations, is to the effect that no dead deer were found after the first rain. It would appear that the disease is caused by some bacterial organism, but just what one is still to be determined. It does seem certain that neither anthrax nor foot and mouth disease is responsible.

DISEASE MAKES SERIOUS INROADS ON NUMBER OF MULE DEER.

During the latter part of the summer and early fall, various reports reached Klamath Falls relative to deer dying in the Modoc National Forest south of the Oregon-California line about forty miles. A number of examinations had been made of dead deer by veterinarians in the belief it was some contagious disease such as foot and mouth or perhaps anthrax. A number of conflicting reports as to just what the trouble was were received and, it appearing that no steps were being taken to remedy the situation, it was decided to investigate and if possible determine the cause of the pestilence. To accomplish this purpose Dr. George T. Casper, federal veterinarian stationed at Klamath Falls, Marion Barnes, Klamath County Game Warden, and C. A. Henderson, Klamath County Agricultural Agent, made the trip.

FIG. 12. Mule deer with locked horns. Found 9 miles northeast of Adin, Modoc County, by Deputy Fred French after following tracks found November 23, 1923. Photograph by Deputy Fred French.

The first dead deer were encountered at Hackamore Springs, about forty miles south of Malin, Oregon, near the Lookout Mountain road. Inspection was made covering approximately 160 acres in the immediate neighborhood of the old reservoir and 65 dead mule deer counted and a few live ones in a weakened condition nearby. The spring itself was entirely dry, nothing remaining except a small tract of the filthiest mud imaginable, not to exceed 30 feet in diameter. Evidence showed that deer had been wallowing in this daily and all carcasses of dead deer also showed that large quantities had been eaten.

Inasmuch as the spring has provided a watering place for years, this being the first season that it has dried up, no doubt the filthy mud was the only source of moisture for miles around—probably 15 or 20 miles in any direction. In addition to having mud about the legs and the underline of the body, nearly every carcass showed evidences of the deer having had its nose in the mud up to the eyes and conditions about the mouth showed that they had been eating it.

One deer in a weakened condition was killed and thoroughly examined. No evidences of disease were noted except an abscess on one of the teeth. All internal organs appeared normal in every respect, except the stomach, which was completely filled with the filthy mud.

A report had been received that the analysis of the mud showed the presence of arsenic, but even if this had not been the case, it is doubtful if any living animal could carry such a huge quantity of mud in its stomach and still survive.

All the dead deer found were within a radius of not to exceed half a mile of the old spring site, the greater number being

FIG. 13. The best of friends. An Airedale takes good care of a black-tailed fawn near Marysville, California.

in the immediate vicinity, with the number diminishing farther back, giving conclusive proof, in the judgment of those men making the trip, that the source of the trouble was the lack of water and the filthy mud.

Upon return to Klamath Falls, the matter was placed before the Klamath Sportsmen's Association and immediate steps were taken by this body to rectify, as far as possible, these conditions. Six watering troughs were built and placed at the old spring site and water hauled from Malin, Oregon, by truck. The troughs were filled three times, but practically all deer had died before this protective measure was undertaken, although a few deer did come back and drink after the troughs were installed. Had these troughs been installed and the mud hole fenced up at an earlier date, it is believed that a large number of deer would have been saved as the loss around this spring alone must have totaled several hundred. Due to the fact that this was in Modoc County, California, a considerable distance from the county seat and in a very mountainous district, and also somewhat removed from Klamath County jurisdiction, the matter was overlooked until such a late date that the deer in that territory received a very serious blow. Inasmuch as the number of mule deer are decreasing from year to year, it is to be hoped that a condition of this kind will not be allowed to occur again and, should another dry season like the past summer arrive, that necessary steps be taken in time to prevent such an occurrence.—C. A. Henderson, County Agent, Klamath Falls, Oregon.

SAN DIEGO ESTABLISHES BIRD SANCTUARY.

There are few places in the state where so many shore birds congregate as upon the shores of Mission Bay in San Diego County. Furthermore, the waters of the bay have been a famous resort of waterfowl. During the past year a concerted effort has been made by the San Diego Society of Natural History to have this area closed to shooting and made a bird sanctuary. The support of the sportsmen was finally won and on October 13, the city council passed an ordinance setting aside Mission Bay as a bird sanctuary and prohibiting all shooting thereon. The ordinance goes into effect on January 16, 1925, or, in other words, at the end of the present open season on waterfowl. Proper protection should make this one of the notable wild fowl sanctuaries of the state.

THE WEIGHT OF A MULE DEER.

There is much discussion as to the actual weight of a dressed mule deer such as inhabits the lava beds of Modoc County. Mr. William S. Brown, of the Forest Service, is responsible for the statement that one specimen which he saw and helped weigh during the season of 1920, killed by Mr. L. G. Renshaw, tipped the scales at 270 pounds. This was after the hide, head, feet and entrails had been removed. The antlers had a spread of 36 inches, with eight distinct points on each horn.

KLAMATH LAKE TO BE REFLOODED.

All of those who have become interested in the plan to restore the Klamath Lake Bird Reservation, by reflooding Lower Klamath Lake, will be glad to hear that official word has gone out from the Department of Agriculture at Washington that water will be turned back into the lake. Exactly how soon this will be accomplished, no one knows. At present, the matter is again held up due to protests by a few farmers who will be affected. Hearings must be held and reasonable adjustments will doubtless have to be made. At any rate, the situation looks good to those interested in birds.

GAME FARMS NOT ENTIRELY SUCCESSFUL.

According to the Pennsylvania Game Commission, thousands upon thousands of dollars have been spent and large numbers of eggs from wild game birds collected and sacrificed in an effort to produce native game birds, but the results up to this time have been unsatisfactory. "Certain game animals have been reared in captivity with a fair degree of success for many years past, but, invariably, the stock produced is not nearly as desirable as the animals reared on free, unrestricted range.

"After giving long and careful study to all phases of the question, the idea of game farms upon which to rear game in confinement was abandoned and the Commission sought a plan by which our native and useful wild life could be multiplied without assistance from man, other than the systematic extermination of vermin, feeding in winter, protection from forest fires and the prevention of overshooting and poaching."

WORLD'S RECORD SWORDFISH CAUGHT AT CATALINA.

Apparently, there are always in the sea bigger fish than have ever been caught, for on August 8, 1924, Mr. Harry J.

Mallen caught a broad-billed swordfish, *Xiphias gladius*, weighing 528 pounds; length, 12 feet, 9 inches. Up to 1916 the record was a 463-pounder, caught by W. C. Boschen. In 1923, Andy Martin landed a 474-pounder, the largest fish of this species until the catch of last August. The record fish of 1924 took 48 minutes to land and was the result of perseverance. Mr. Mallen went after the record in earnest. He had fished every day regularly for 45 days before making his catch. The big swordfish is being mounted and will be presented to the Tuna Club.

RODENTS CONSUME LARGE QUANTITIES OF PINE SEEDS.

The past summer, tests were made at the Southwestern Forest Experiment Station to determine the quantity of pine seeds necessary for the existence of the Rocky Mountain golden-mantled ground squirrel and the San Francisco Mountain chipmunk. The results showed that the ground squirrel ate 340 pine seeds in one day and night, while the chipmunk consumed 237. Dr. W. P. Taylor of the Biological Survey, who conducted the tests, points out that the policy of leaving on cut-over areas but four seed trees, with their 92,000 seeds in a given year, would be insufficient to do more than win the grateful appreciation of the resident squirrels and chipmunks, were it not for the young pines that actually do come in on these cut-over areas in defiance of biological statistics.

AGE OF SHAD STUDIED.

The investigation authorized by the Connecticut legislature and undertaken by the Board of Fisheries and Game has shown that male shad in the Connecticut River range from four to eight years in age, while the females run from seven to ten years. (N. Borodin, *Science*, 60, p. 477.) Adult shad of both sexes of sizes less than 32 centimeters in length occur, as a rule, only in the sea. Age determinations were secured by studies of the scales. It was found that the transverse grooves running completely across the scale have a constant relation to the rings of growth, thus furnishing supplementary information when the annuli are not easily distinguished. Examination of the otoliths were also made and these agree with the scale readings. The results of these investigations are doing much to add to the meager existing knowledge of shad migrations.

MISSOURI DUCK KILLED IN ALAMEDA COUNTY.

Mr. F. Boeken, manager of the Municipal Railways of San Francisco, killed a female pin-tail duck at Centerville, Alameda County, November 13, 1924, bearing a band No. 101,855. Upon reporting this return promptly to the U. S. Biological Survey, information was forthcoming that this same bird was banded at Cuivre Island, near Firma, Missouri, on January 14, 1923, by L. V. Walton, who operates a duck station for Mr. Joseph Pulitzer of St. Louis, Missouri.

In that nearly two years elapsed between the banding of the bird and its capture, this bird may well have returned to breeding grounds in the north and then migrated westward in 1924, rather than down the Mississippi Valley. This seems more reasonable to believe than that the bird traveled from east to west.

NAPA RIVER FAMOUS STRIPED BASS FISHING GROUND.

If the increased number of fishermen on the Napa River is a criterion of the sport available, then the striped bass fishing of this region must be improving yearly. Each week end the river is lined with hundreds of fishermen, and those who know how are having rare sport. During the past month, several large fish have been taken from the city wharves. Occasionally, a fish weighing 40 pounds is taken. The striped bass fraternity has a large membership in the city of Napa.

CRAYFISH DISCOVERED IN SOUTHERN CALIFORNIA.

Professor S. J. Holmes of the University of California, writing in *Science*, reports crayfish from a stream near Pasadena, California. The species proved to be *Cambarus clarkii*. All the other West American crayfishes are members of the genus *Astacus*, while all the crayfishes of the United States east of the Rocky Mountains, with one exception, belong to the genus *Cambarus*. Although the species involved has been previously reported from Texas and several other southern states, it has not been known heretofore west of the great southwestern deserts. It is possible that the species may have been artificially introduced. Certainly, it would seem that the deserts would form a barrier to the migration of such a species.

THE INGENIOUS VIOLATOR.

The extent to which violators of the game laws go to evade the game warden would make very interesting reading. Just as a sample, hear these ruses utilized by violators of the law which places a size limit on Pismo clams. Game wardens on the shore of Monterey Bay, near Watsonville, have watched women sitting

on the beach catch an undersized clam tossed to them by their husbands, cut the meat from the shell, place it in a jar, and then either throw away or hide the shell to conceal evidence that might be used against them. Another couple were apprehended in using quite a different method. Legal sized clams were boldly carried in a sack by the man, while his spouse filled her bloomers with the undersized ones. They came to grief, however, when the elastic of the bloomers parted and the undersized clams were deposited at the feet of the game warden.

BLACK BASS IN BEAR LAKE.

There may be some who gloat over the surreptitious planting of black bass in Bear Lake, in the San Bernardino Mountains, but trout anglers have a real reason for concern. Although the attempt is being made to have lakes and streams planted in an orderly and sensible manner, yet sometimes this is impossible because of individuals who try to follow their personal preference rather than a well laid scheme worked out by state authorities. Black bass are now to be found by the thousands in Bear Lake and appear to be increasing very rapidly. Judging by past experience, trout will not very long survive the presence of black bass. In reservoirs where black bass have been introduced, trout fishing declines. The black bass is distinctly predatory and wherever a sufficient food supply of minnows or other small fish is not available, trout fall victims.

Bass fishing is erratic. Some days the fishing may furnish fine sport and the very next day the fish will not bite at all. A change from trout fishing to bass fishing on Bear Lake is to be deplored. The place for bass is in the lakes and streams of lower altitudes where the water is too warm and full of organic matter for trout to survive. Cooperation by anglers will prevent the destruction of well laid plans and a repetition of the undesirable conditions in Bear Lake.

PROPOSED TAHQUITZ NATIONAL GAME PRESERVE.

On April 11, 1924, Congressman Swing of El Centro introduced a bill (H. R. 7823) providing for the extension of the boundaries of the Cleveland National Forest and creating therein a National Game Preserve under the jurisdiction of the Department of Agriculture. The proposed preserve is situated in the San Jacinto Mountains of Riverside County, comprising an area of forty square miles, ranging in altitude from 2500 to 10,805 feet. The drainage is toward the east or desert side of the range. The higher altitudes have a growth of pines and white fir, while the lower elevations are rocky and brush covered. The name selected is that given by the Indians to the main valley and the peak at the southwest corner of the preserve. The game concerned is the California mule deer.

Those believing in the efficacy of refuges to care for big game will readily join forces with those sponsoring this new refuge. However, a quicker and more efficient way of handling the matter would be to advocate the area as a state game refuge. We fail to see whereby anything is to be gained by federal as against state management. On the other hand, there are several reasons why state control is to be preferred, not the least of which is the legal aspect—*the ownership and control of deer is vested in the state.* Numerous Supreme Court decisions could be cited.

LOS ANGELES COUNTY HELPS IN LAW ENFORCEMENT.

A report from Stuart J. Flintham, county game warden of Los Angeles County, shows that his office made 235 arrests during the fiscal year ending June 30, 1924. As a result of the convictions made, a total of $10,040 was assessed in fines and a total of 2478 days of jail sentence meted out. The larger proportion of arrests were made for violations of laws relating to deer, trout and abalone.

NATIONAL GAME REFUGE IN OREGON PROPOSED.

Heralded as a necessary step in saving two of the most typical game species of the West, the prong-horned antelope and sage grouse, a bill indorsed by the Oregon Game Commission providing for a large refuge in Lake County, Oregon, is to be introduced in congress. The area is a high rocky sagebrush plateau unsuitable for agriculture and the title to the land is largely vested in the federal government. The success of the movement is dependent upon a favorable attitude of the stockmen who have been grazing the area. The United States Forest Service and Biological Survey have issued statements promising the stockmen grazing privileges up to the reasonable utilization of the forage. The situation is complicated as a result of the confessed overgrazed condition of the range.

COMMITTEE ON KAIBAB DEER MAKES REPORT.

Immediate reduction of the deer herd on the Kaibab National Forest, in northern Arizona, is strongly urged by the special

committee appointed by the Secretary of Agriculture to study and report on the conditions existing on the Grand Canyon Game Preserve. The report having pointed out the necessity of reducing by one-half the great herd of deer, three alternative methods were offered: First, the giving of deer for restocking to any organization which would bear the charge of capture, crating and transportation. If this method, after fair trial, did not meet the emergency of rapid reduction, the committee recommended opening the reserve to shooting under special government regulations and supervision. If these methods fail, as a last resort, government killing was recommended.

The first method, which was to have precedence, was begun immediately and the Forest Service offered to give away deer at an estimated cost of $35 at the nearest railway shipping point. At this rate, the minimum expense of removal of half the herd would amount to $525,000. As if this obstacle were not enough, the whole plan was halted on orders from Governor Hunt of Arizona to the effect that anyone attempting to disturb the deer would be arrested. District Forester Rutledge is reported to have stated that the state of Arizona would be responsible for damage to the range and the loss of deer through starvation. Later permission was granted for the killing of a thousand deer and a wild scheme of driving thousands across the canyon to better feeding grounds was sanctioned.

KING SALMON IN EASTERN LAKES.

For many years hundreds of thousands of king salmon eggs, obtained in Pacific coast states, were shipped east by the U. S. Bureau of Fisheries for stocking eastern lakes. Although occasional reports came of salmon being caught in these lakes, yet we have never seen a concise report of the actual results of these plantings until there came to hand a bulletin entitled, "The Status of Fish Culture in Our Inland Public Waters and the Role of Investigation in the Maintenance of Fish Resources," by Dr. Wm. C. Kendall, ichthyologist of the Roosevelt Wild Life Forest Experiment Station. The following information on the subject has been taken from this bulletin: Sunapee Lake, New Hampshire, has always been noted for its numerous and large trout, as well as a dozen other native species of fish. Through the years this lake has been subjected to numerous plantings of exotic species, no less than 14 species being concerned. In 1904 the king salmon of the Columbia River was introduced and some were planted nearly every subsequent year. The first catch of this species was made two years later. Subsequently, they were caught in increasing numbers and it was estimated that in 1910 between 400 and 500 were caught, ranging from 2 to 17 pounds in weight. Large catches were also made in 1912 and 1913, but thereafter the catch became smaller and by 1917 they were practically gone. According to the New Hampshire Commissioner, the fish did not reproduce and they were all caught out. It is believed that none of the fish grew to be more than five years of age.

The experience with the king salmon in Massachusetts has been similar to that of Sunapee Lake. Between 1913 and 1920 inclusive, 420,215 young king salmon had been planted in 15 ponds and lakes in this state: The Division of Fisheries and Game stated in 1920 that "constant stocking would be the price of whatever salmon fishing our waters might afford." In most of the ponds stocked, no salmon were ever taken, while in a few others but a very few were obtained. In 1919, the planting of king salmon by the Massachusetts Commission was abandoned because of the difficulty of securing eggs.

It appears, therefore, that the experimental planting of king salmon in eastern lakes has been a complete failure. Dr. Kendall's comment is as follows: "Indiscriminate plantings of fish in the past and even today is the cause of much of the present unsatisfactory situation. Instead of trying to maintain a supply of fish in those waters to which the fish were known to be adapted and in which they formerly thrived, the fish have been scattered broadcast into large lakes and little ponds near and remote, without regard to the habits or physiological requirements of the fish, and often to the detriment of the fish native to the waters into which the transfers were made."

FISHERY STATISTICS.

California is doing pioneer work in securing accurate data on the fisheries of the state. Until recently the annual catch of fish was merely an estimate. But with suitable legislation the Fish and Game Commission has been able to secure statistics of the actual catch. As the plan is to make the furnishing of these statistics permanently compulsory, there will be available data valuable for determining any decline of the fisheries and any need for additional protection to certain species. Although in Europe more attention is paid to the conservation of

the fishery resources, yet statistics there are still estimates. No permanent advance along the lines of our fishery conservation can be expected until neighboring states follow the example set by California, and adopt a similar system.

GAME MANAGEMENT.

"Game management is the scientific balancing of all that concerns the numbers and welfare of game on a given area. It includes not merely the limitation of seasons and bag but also such matters as the food supply, the distribution, the ratio of sexes, the maintenance of an adequate breeding stock, the absolute number that should be removed annually, the control of predatory animals, the places where game may or may not be shot, and preeminently the creation and maintenance of game preserves. Such a comprehensive scheme is a matter of positive administration and not merely a question of negative restrictions.

"Almost everything which concerns the abundance and the welfare of game is variable. Not only does the weather seriously affect their food supply and breeding conditions, but the nature of the country may change with great rapidity within a very short period of time. The weather alone, even where there is no shooting, can reduce the stock of game in a given area in one season from abundance to comparative scarcity by interfering with the normal reproduction during the breeding season or by injury to the food supply through serious drought or by heavy rain or snowfall. Conversely, favorable conditions of weather alone may change scarcity into abundance. When a country is settled, the building of fences and cultivation of the land will drive away or partly reduce the number of large game thereon. Where game animals are dependent upon different ranges for winter and summer, the occupation of one or the other of those ranges will suffice to exterminate them.

"Other factors affecting the numbers of game in any given area are the change from an agricultural to an industrial community, the clearing of lands which have been used as cover, the drainage of lakes or marshes which may be the special haunts of certain species, in fact any of various influences which inevitably follow the advance of civilization, may have their effect. Shooting is only one of the factors affecting the conditions of game and is very often one of the least important. An arbitrary or inflexible statutory limitation can evidently not suit varying conditions.

"The scientific management of game by a special authority, such as a commission, should have the power to change regulations from year to year in order to meet the changes in local situations. The special authority charged with game management should have sufficiently elastic powers to control not only the open seasons, the shooting areas, the refuges, and the bag limits, but also the absolute numbers which may be killed in any given locality each season. Upon such principle of game management does the future of much of our wild life depend.

"The fundamental purpose and principle of game management is the maintenance upon a given area of the maximum breeding stock which that area will support in a thrifty condition. The excess over the maximum, which when well managed will amount to approximately the yearly increase, should be available for purposes of restocking elsewhere and for recreation and should be periodically removed to prevent an overstocking of the area."—Extract from report of the Kaibab Deer Investigating Committee, National Parks Bulletin No. 41, October 23, 1924.

PREDATORY ANIMAL CAMPAIGNS.

There appears to be a reaction, largely attributable to zoologists, to the continued emphasis placed upon the destruction of predatory animals. The opposition met by the arms and ammunition companies in furthering "vermin shoots" has been particularly noticeable. Last spring the American Society of Mammalogists, a professional society of international membership of students of wild life, including practically all field naturalists, pointed out the danger which lies in propaganda for the destruction of "vermin" and predatory animals by passing this resolution: "There exists no real occasion for a nation-wide campaign for the destruction of predatory animals, and this is particularly unwise because it furnishes a pretext for illegal hunting out of season."

OIL SEPARATOR MAY SOLVE OIL POLLUTION PROBLEMS.

Several oil separators have been invented which successfully extract the oil from water pumped from the bilges of ships. The oil is recovered sufficiently free from water to be pumped back directly into the ship's bunkers. On the other hand, the water, after purification by filtration, contains practically no oil. Demonstrations of these oil separating plants designed to prevent oil pollution

have been demonstrated in England and New York.

On June 4, 1924, an oil pollution act was passed by congress prohibiting vessels from dumping oil overboard in territorial waters and authorizing an investigation.

FUR FARMING MANAGEMENT STUDIED.

Conditions in the fur farming industry in this country, in Alaska, and in Canada are being surveyed, as the first step of the recently created Division of Fur Resources of the Biological Survey, United States Department of Agriculture. Frank G. Ashbrook, chief of the new division, has been making a special study of Canadian methods of fur farming and of the attitude of the Canadian government toward the industry. In August and early in September he visited a number of fur farms on Prince Edward Island to observe methods of feeding, breeding, and sanitation, and went also to Quebec and Montreal to discuss with representatives of the Canadian fur trade the general trend of the season's fur business, the outlook for the coming year, and the quality of skins now on the market. Fur farming in Canada is found to be progressing satisfactorily and the business on a more stable basis. Many new ranches have been established on Prince Edward Island during the last three years, indicating that the interest taken by the Canadian government in fur farming is producing substantial results.

The two associations representing the silver fox industry in the United States amalgamated in June to form the American National Fox Breeders' Association, and its secretary visited Ottawa while Mr. Ashbrook was there to confer with him and with Canadian officials relative to the methods employed in registering silver foxes. The Canadian government is fostering the fur industry and endorses the National Livestock Records, the board which registers silver foxes. Government inspectors examine all foxes before they are eligible for registry and require rigid enforcement of sanitary standards on ranches. In this country there is no officially recognized system of registering fur animals, but every effort is made by the Department of Agriculture to bring about improved breeding, especially of fur bearers in captivity, the majority of which are foxes. In Alaska alone there are approximately 500 fur farms and the industry there is represented by four fur-farmers' associations.

NATIONAL FORESTRY POLICY BILL SIGNED BY PRESIDENT

President Coolidge signed the Clarke-McNary forestry bill on June 7 which appropriates $2,700,000 for the protection and reforestation of national, state and private forest lands. Forestry leaders throughout the country acclaim the bill as the greatest conservation measure passed by congress in a generation, and state that it will play a large part in the successful solution of the problem of idle land and costly lumber that is now confronting the nation. The late President Harding in endorsing this legislation said:

"Being firmly convinced that national leadership in conserving, protecting and encouraging the growth of our timber resources is absolutely necessary, I feel that legislating along the lines proposed * * * represents an important step in the perfection of a truly national forestry policy."

The Clarke-McNary bill aims at establishing through federal leadership a coordination of public forest policies throughout the United States. The principal objects are the inauguration by the states of adequate protection of the forests against fire, and the introduction of state taxation systems that will not confiscate the value of forest growth. The sum of $2,500,000 is appropriated annually by the bill to enable the federal government to cooperate on a fifty-fifty basis with states that will establish or have an approved forest protection organization; and for the study of the effect of tax laws and practices upon forest perpetuation and the devising of suitable taxation methods.

The bill also appropriates $100,000 annually for the production and distribution of forest tree seeds and plants for the purpose of establishing forests upon denuded or nonforested lands; and another $100,000 each year to assist farmers and other owners of land in establishing, improving and renewing wood lots and shelter belts. It is provided, however, that the amount expended in any one year by the federal government in carrying out these provisions shall not exceed the sum expended by the state or other cooperating agency for the same purpose.

The new forestry measure establishes a broader legal basis for further acquisition by the United States of forest lands on the watersheds of navigable streams, and authorizes the acceptance by the government of gifts or bequests of forest land, the same to become a part of new or existing national forests.

The President is further authorized, in his discretion, to establish as national forests any lands within the boundaries of government reservations other than national parks, national monuments and Indian reservations, that are suitable for the production of timber.

The provisions of the new national forestry policy bill will be administered by the Secretary of Agriculture.

FACTS OF CURRENT INTEREST.

Permits were issued to 3383 hunters during the open season on deer in the Trinity National Forest.

The patrol force has been increased slightly. California wardens have a greater area to patrol than wardens in any other state.

The twenty-eighth biennial report of the California Fish and Game Commission came from the press last month and has been mailed to libraries.

With the October issue of California Fish and Game the periodical completed its tenth volume, a reminder of ten years of service in bringing to the people of the state reliable information on the activities and accomplishments along conservation lines.

Fewer changes in game laws and a chance to better enforce those we have will be the main request made of the legislature.

Resolutions favoring the Public Shooting Grounds-Game Refuge Bill failed to receive support at the recent meeting of the Western Association of Game Commissioners in Portland. Opposition was based largely on state rights.

Permanent cement footings for several egg-collecting stations are being installed.

It is probable that other Pacific coast states, following the lead of California, will now take definite measures to save the breeding grounds of migratory fish.

HATCHERY NOTES.

W. H. Shebley, Editor.

NEW EGG-COLLECTING STATIONS PLANNED FOR KLAMATH.

In furtherance of the plan to increase the output of the hatcheries, plans are being laid to establish two new egg-collecting stations on the Klamath. Both salmon and trout are to be taken on Shackelford Creek, one of the tributaries of the Scott River, and a location for taking trout is being sought on Beaver Creek, the largest tributary running into the Klamath from the north side. A double rack is to be installed on Bogus Creek so as to increase the take of eggs at this station.

NEW EGG-COLLECTING STATION PLANNED FOR MONO COUNTY.

Rush Creek, in Mono County, has been chosen as a site for a new egg-collecting station for the taking of black-spotted trout. This creek has long been noted for its fine run of trout and the site chosen above Grant Lake should furnish a splendid take of eggs for use in the Mount Whitney and Tahoe hatcheries.

A NEW FEATHER RIVER HATCHERY.

After experimenting at two different sites on the Feather River and finding the situation unsuited to hatchery work, a fine location was secured near Clio, where water from two creeks is available to supply a hatchery. Last year's operations at this site proved successful and plans were drawn for a new hatchery. The hatchery building and superintendent's cottage have been completed by the Department of Public Works and everything will be in readiness when the spawning season begins next spring. From standpoint of beauty of surroundings and of water supply, this hatchery will be notable. Plumas County egg-collecting stations will be able to supply a complement of rainbow eggs for hatching, and lakes and streams of Plumas and Nevada counties will be assured more fish for stocking.

SUNAPEE TROUT PROMISED.

Plans are being laid to import for California streams the famous Sunapee trout of New Hampshire, considered by many the most beautiful trout of eastern lakes. Negotiations are under way with the Massachusetts Fish and Game Commission whereby a supply of these trout may be secured through exchange.

HATCHERIES UNDERGOING NEEDED REPAIRS.

After several seasons of operations, repairs to buildings and equipment in the hatcheries becomes necessary to prevent depreciation and to assure sanitation so necessary in the rearing of fish. Several of the hatcheries are receiving attention in this regard at this season of the year, preparatory to the hatching season.

FORT SEWARD HATCHERY.

Sixty new troughs have been installed in the Fort Seward Hatchery. New tanks and flumes have been built and the hatchery overhauled and repaired so that it is now a modern hatchery in every respect. Plans are being made to operate this hatchery to its fullest capacity next season to supply the streams of northern Mendocino and Humboldt counties with a sufficient number of trout fry to meet the demands of the anglers in that section.

TALLAC HATCHERY.

Tallac Hatchery has been equipped with an entirely new set of troughs, tanks, etc., so that this station can turn out its usual supply of eggs and fry.

FALL CREEK HATCHERY.

Fall Creek Hatchery, located on Fall Creek, one of the tributaries of the Klamath River, has had a thorough overhauling. New troughs have been installed, a large concrete settling tank has been constructed and the station placed in first class condition for next season's operation.

It is planned to construct another salmon fry rearing pond at this station this coming spring to rear a larger number of salmon fry to the proper size before distributing them in the Klamath River.

BEAR LAKE STATIONS.

The traps and buildings, as well as the troughs, have all been repaired and improved at the Bear Lake stations, and, if seasonal conditions are favorable, the usual number of trout eggs will be collected at these stations next season. The season just passed has been the best in years for trout fishing in Bear Lake. This is a remarkable showing for fish-cultural operations, as all the fish in Bear Lake are the result of hatchery operations, there being no spawning grounds

for natural propagation in the small streams tributary to this lake.

DOMINGO SPRINGS AND CLEAR CREEK STATIONS.

The Plumas County stations, located on Clear Creek and Rice Creek, have been put in order for next season's work and the Department of Fish Culture is expecting the usual number of eggs to be collected from these stations next spring.

A trap has been installed in Warner Creek, at its junction with Rice Creek, which, it is expected, will increase the number of eggs that will be collected in this section, as there is generally a good run of fish in Warner Creek during seasons of normal rain and snow fall.

MOUNT SHASTA STATION.

Mount Shasta station has been repaired, a new pipe line installed for the power house, ponds and tanks have been repaired; a new store house for the storage of shipping cans, etc., has been built; a boiler for sterilizing and cleaning the shipping cans has been installed; the buildings painted and the station generally overhauled and repaired.

Two hundred new shipping cans have been purchased for use in the distribution of the fry.

UKIAH HATCHERY—BROOKDALE HATCHERY.

Ukiah and Brookdale hatcheries have been improved and general repairs made. New troughs have been installed in the Ukiah Hatchery and new foundation placed under the old building and a new roof added.

It is planned to repair and improve all the other stations as soon as funds are available.

COMMERCIAL FISHERY NOTES.

N. B. Scofield, Editor.

NORTH PACIFIC HALIBUT INVESTIGATIONS UNDER THE NEW INTERNATIONAL TREATY.

Following the demonstration that the halibut banks of the North Pacific have been progressively impoverished by too intensive a fishery, a treaty between the United States and Canada for the protection of this species was proclaimed October 22, 1924. This treaty was at its inception the result of the desire of the trade itself, as well as of scientists and conservationists. It is chiefly important in that it is one of the first international treaties for the protection of deep sea fish, and in that it provides for the appointment of a commission to investigate the biology of the halibut and the condition of the banks. This latter feature is particularly important in view of the fact that there is general agreement among well informed men that the treaty, in order to be effective, will need considerable revision as further knowledge concerning the fishery is acquired.

Acting as commissioners for Canada are J. P. Babcock, of the British Columbia Fisheries Department, who is the chairman, and W. A. Found of Ottawa, Director of Fisheries for the Dominion; representing the United States are Henry O'Malley, Commissioner of Fisheries, and Miller Freeman of Seattle, publisher of the *Pacific Fisherman* and of the New York *Fishing Gazette*. In the appointment of these commissioners there is evident a care, not only for the interests of the two countries as a whole, but also for the welfare of those localities most immediately interested in this particular fishery.

Every since 1914–15, when Mr. Will F. Thompson, then employed by the Provincial Fisheries Department of British Columbia, gathered extensive statistical and biological data showing the decline in abundance of the halibut on the banks, it has been clear that protection was necessary. The essentially international character of the fishery has made cooperation between the United States and Canada a condition of any effective regulation for the prevention of overfishing. These facts were recognized a number of years ago by fishermen and dealers, who themselves had practical reasons to consider depletion probable, as well as by those scientists to whom Mr. Thompson's findings gave proof of its existence and imminence. The halibut treaty has been in process of formation and consideration practically ever since, final ratifications having been exchanged at Washington October 21, 1924.

Now that the preliminaries have been arranged and investigation is about to proceed, it has been decided that the commission itself will be chiefly of an administrative nature, while the scientific work will be conducted under the direction of Mr. Will F. Thompson, now in charge of the California State Fisheries Laboratory, with the counsel of a scien-

tific advisory board, appointed at the first meeting of the commission held at Seattle November 19 to 24. Professor John N. Cobb, Director of the College of Fisheries and Food Preservation of the University of Washington; Dr. C. McLean Fraser, Professor of Zoology at the University of British Columbia, and Dr. W. A. Clemens, Director of the Marine Biological Station at Nanaimo, will compose the consulting body.

Inasmuch as the character of the work which has been carried on at the California State Fisheries Laboratory and elsewhere by the Commercial Fisheries Department has been of essentially the same type as that contemplated for the preservation of the halibut, the program of the state has in effect received an emphatic ratification. Mr. Thompson proposes to adopt the same common-sense method of statistical observation which has been utilized in California and to interpret and support the statistical evidence by biological research. It is therefore the feeling of the Commercial Fisheries Department that his appointment demonstrates that their program is in accord with the best-informed opinion of fisheries experts on this coast, since the International Halibut Commissioners appointed under the treaty are all of them men of long and intimate acquaintance with fisheries problems and research.

The halibut fisheries in the North Pacific have an annual value of $10,000,000; they are carried on by deep sea fishing vessels, landing their catches mainly at Ketchikan, Prince Rupert, Vancouver and Seattle. The halibut is the largest of the flat fishes, frequently reaching a length of over three feet and weighing hundreds of pounds. It is not the same as the California halibut, which is much smaller. The true halibut reaches maturity at an average age of 12 years, and may attain an age of over 25 years. As on many of the banks the age of the fish has been reduced by overfishing to below eight years, the danger to the future of the fishery is obvious. Its history shows a progressive movement of the fishing fleet to more distant waters, and the possibility of overfishing has been conclusively demonstrated on every bank which has been tapped.

It should be very apparent from experience in this case that the supply of fish in the sea is not inexhaustible, and that some accurate record of its fluctuations must be kept for every large fishery, in order to make possible effective conservation measures. It is therefore sincerely to be hoped that the splendid system of statistics and allied biological research which has been instituted in California will be maintained there, as well as that its methods will be extended to the halibut research. For this purpose, Mr. Thompson hopes to retain some contact with the laboratory in California so that the continuity of the program there undertaken may be assured.

FRESH FISHERY PRODUCTS, 1923.

Statistics compiled for the biennial report of the Commission give a vivid picture of the return to normalcy of the fisheries following the post-war slump.

The catch of fish taken in the waters of California in 1923 amounted to 223,045,907 pounds, as compared with 164,569,599 pounds the previous year, an increase of 58,476,308 pounds, or 26 per cent. The species taken in the largest quantities were sardines, 158,159,356 pounds; tuna, including albacore, 16,562,351 pounds; salmon, 7,090,260 pounds; sole, 7,085,085 pounds; barracuda, 5,135,824 pounds; skipjack, 4,579,077 pounds, and yellowtail, 2,968,596 pounds.

The imports of fish from Mexico in 1923 doubled, amounting to 23,207,611 pounds, as compared with 11,455,814 pounds in 1922 and 5,745,871 pounds in 1921. Many fishermen operate off the lower California coast, bringing their catch to San Diego or other southern California ports, where the product reaches a cannery or fresh fish market. The catch of yellow-fin tuna taken in Mexican waters increased from 6,132,382 pounds in 1922 to 10,408,029 pounds in 1923; skipjack from 1,746,670 to 6,883,445 pounds and barracuda from 1,528,770 to 2,064,751 pounds.

CONSERVATION IN OTHER STATES.

OREGON COMMISSION ESTABLISHES EDUCATIONAL DEPARTMENT.

The Oregon Game Commission has secured Mr. Otto M. Jones, formerly Fish and Game Warden of Idaho, as educational director. Motion picture reels are to be made available and reissuance of the magazine, *The Oregon Sportsman*, now published bimonthly, has been begun. The magazine was discontinued in 1918 on account of conditions brought about by the World War.

The following are among the interesting facts gleaned from the first issue of the periodical:

"Since the inception of the Game Commission in 1921, the number of game fish hatcheries has been increased from five to seventeen, with three others under construction at the present time.

"The number of young trout planted since the inception of the Commission in its present form has been increased from less than 6,000,000 in 1920, to 15,000,000 in 1921, 24,000,000 in 1922, and 31,000,000 in 1923, with the probable planting of approximately 40,000,000 in 1924.

"During the present season we have secured 11,000,000 eggs by purchase and exchange from outside the State of Oregon, which in a measure accounts for the large increase in the number of young trout which will be planted during the present season.

"The Game Commission is now operating two game farms devoted entirely to the rearing of Chinese or ring-necked pheasants, and a third game farm will be in operation next season."

WEST VIRGINIA ESTABLISHES REFUGES.

The Game and Fish Commission of West Virginia has obtained the consent of the government to purchase two tracts of land, one to be used as a state forest park and game preserve and the other as a state bird farm. The first area to be purchased is a tract of 10,700 acres in Pocahontas County, and the second is a tract of 225 acres of upland farm and woodland in Upshur County.

MARYLAND ATTEMPTS ADDED PROTECTION FOR RABBITS.

The disappearance of the standard game of the farmer and small boy has caused many a law to be placed on the statute books of eastern states. Maryland started legislation of this kind by attempting the passage of a bill prohibiting the sale of cotton-tail rabbits. Although a favorable report was given by the committee, yet the bill failed of passage.

ARKANSAS COMMISSION EXPLAINS HOW TO HELP.

The Arkansas Game and Fish Commission has begun the publication of the *Arkansas Conservationist* with a motto modeled after that long used by the California Fish and Game Commission, "Education Means Conservation." On the back cover of the second issue appears the following:

HOW YOU CAN HELP.

(1) Kill and take within reasonable limits.

(2) Educate your neighbor to the crying need for conservation.

(3) Ask your senator and representative to foster and support conservative measures.

(4) Fight the destructive forest fire.

(5) Organize a sportsmen's protective club.

(6) Respect the property rights of others.

(7) Assist constituted authorities in law enforcement.

(8) Abide by the laws of state and nation and see that your thoughtless neighbor does likewise.

(9) Preach a conservation sermon. The converts will surprise you.

Saving our wild life is a very small job if EVERYBODY helps. If a few must carry on the work the results will be disastrous.

Ask for help in organizing your club. Preach a conservation sermon or report a violation. It all helps.

BIRD PROTECTION IN CANADA.

Canadian conservationists have succeeded in utilizing the best means of advertising yet discovered—an official cancelling stamp of the post office. On the face of many a letter may be read, "Protect the birds and help the crops." Many there are who seek to utilize this means of advertising, but few there are that actually succeed.

BRITISH COLUMBIA SUPPOSEDLY HAS THE LAST BREEDING TRUMPETER SWANS.

Motion pictures shown throughout the continent indicate that the trumpeter

swan still frequents two lakes, the location of which is kept secret.

This province also boasts of English skylarks which have become well established in the vicinity of Victoria. This species is the only one of several British song birds which has become acclimatized.

VIRGINIA'S GAME HARVEST.

Following the example of a number of states, Virginia has published a tabulation of the game killed in 1923. The most interesting totals are as follows: Quail, 289,612; ruffed grouse, 5253; wild ducks, 50,982; deer, 793; rabbits, 448,882; oppossums, 65,106. The biggest return to the state in dollars and cents comes apparently from the valuation placed upon rabbits, which is given as $224,441, as against $101,964 for ducks, $144,806 for quail and but $19,925 for deer.

WILD WOOD BISON GIVEN SANCTUARY.

For the preservation of the only two herds of wood bison known to exist in a wild state, the Canadian government has set aside an area of 5000 square miles in the wilderness south of Great Slave Lake. Little had been known of these herds of wild wood bison until a party was sent out by the Canadian government in 1922 to get all available information. It was then learned that the number of bison in the northern herd is at least 500, with twice as many in the southern herd. The animals are considered by some experts to be superior in size, pelage and stamina to the plains bison, to which they are closely related.—*Science Service.*

REPORTS.

Violations of Fish and Game Laws.

FISH CASES.

July, August and September, 1924.

	Number Arrests	Fines Imposed	Jail Sentences (days)
Violations of Angling License Act	5	$145 00	
Trout—over bag limit	2	50 00	
Black bass—undersized	3	20 00	40
Striped bass—undersized, over bag limit	15	420 00	
Striped bass—closed season	2	60 00	
Crabs—undersized; closed season	5	165 00	
Clams—undersized; over bag limit	25	640 00	4
Abalones—undersized; over bag limit	20	520 00	
Lobsters—closed season	2	100 00	
Barracuda—undersized	5	125 00	
Illegal shipment—concealed packages	4	200 00	
Obstructing stream	1	50 00	
Fishing within 100 feet of dams or within 250 feet of fishways	4	100 00	
Violations of Commercial Fishing License Act	16	170 00	
Failure to keep commercial fishing data	1	100 00	
Nets, traps, lines—illegal possession or use	13	930 00	200
Totals	123	$3,795 00	244

GAME CASES.

July, August and September, 1924.

	Number Arrests	Fines Imposed	Jail Sentences (days)
Violations of Hunting License Act	38	$780 00	30
Deer—killing, possession; closed season	28	1,535 00	25
Deer—running with dogs; closed season	2	100 00	
Deer—removal of evidence of sex from hide	2	75 00	
Deer—failure to retain hide-horns	3	150 00	
Deer—killing, possession; does, fawns, spike bucks	43	3,270 00	
Bear—killing, possession; closed season	2	20 00	
Ducks—killing, possession; closed season	6	100 00	10
Shorebirds—killing, possession	3	125 00	
Wild pigeons—killing, possession	2	50 00	
Sage-hens—possession, killing over bag limit	9	175 00	
Quail—killing, possession; closed season	20	630 00	30
Doves—killing, possession; closed season	26	505 00	180
Doves—killing, possession; over bag limit	4	100 00	
Pheasants—killing, possession	2	100 00	
Rabbits, conttontail—killing, possession; closed season	6	125 00	30
Squirrels—killing, possession	3	100 00	
Non-game birds—killing, possession	5	195 00	
Game refuge—hunting or possession of firearms	10	450 00	
Totals	214	$8,585 00	305

SEIZURES OF FISH AND GAME.

July, August and September, 1924

Ducks	18	
Geese	1	
Shorebirds	7	
Doves	157	
Quail	31	
Sage-hens	61	
Non-game birds	3	
Deer meat	1,244	pounds
Deer hides	2	
Deer heads	2	
Cottontail rabbits	6	
Trout	54	pounds
Black bass	28	
Striped bass	1,991	pounds
Salmon	470	pounds
Clams	815	
Lobsters	54	
Crabs	864	
Abalones	262	
Barracuda	1,730	pounds
Set-lines	4	
Nets, seines	5	

STATEMENT OF EXPENDITURES.

For the Period July 1, 1924, to September 30, 1924 of the Seventy-sixth Fiscal Year.

Function	Materials and Supplies	Salaries and Wages	Service and Expense	Property and Equipment	Total
Administration:					
Commissioners			$419 01		$419 01
Executive offices	$94 27	$3,703 78	1,876 10	$0 98	5,675 13
Printing	918 15				918 15
Research and publicity	47 68	1,207 00	230 24		1,484 92
Accident and death claims			678 22		678 22
Department totals	$1,060 10	$4,910 78	$3,203 57	$0 98	$9,175 43
Commercial fish culture and conservation:					
Superintendence	$55 71	$1,756 45	$694 45	$1 85	$2,508 46
Inspection and patrol	1,170 63	4,425 00	1,200 24	39 18	6,835 05
Research	158 97	3,713 05	643 19	88 23	4,603 44
Statistics	40	1,370 32	63 39		1,434 11
Propagation and distribution of salmon	4,990 08	4,026 43	690 76	52 21	9,759 48
Department totals	$6,375 79	$15,291 25	$3,292 03	$181 47	$25,140 54
Sporting fish culture:					
Superintendence	$18 61	$2,645 32	$754 20	$60 53	$3,478 66
Printing	42 65				42 65
Special field investigation	117 85	525 00	73 61	629 31	1,345 77
Propagation and distribution of trout	14 295 28	15 369 63	3,380 16	121 83	33,166 90
Department totals	$14,474 39	$18,539 95	$4,207 97	$811 67	$38 033 98
Patrol and law enforcement:					
Prosecutions and allowances			$2 65		$2 65
General patrol	$848 78	$31,646 71	21,695 04		54,190 53
Department totals	$848 78	$31,646 71	$21,697 69		$54 193 18
Fish and game conservation:					
Mountain lion hunting		$375 00	$221 52		$596 52
Mountain lion bounties			660 00		660 00
State Fair exhibit	$169 83	979 00	2,079 57		3,228 40
Department totals	$169 83	$1,354 00	$2,961 09		$4,484 92
License commissions:					
License commissions			$8,375 50		$8,375 50
Tahoe camping ground	$18 75	$562 00	$0 12	$5 50	$586 37
Grand totals	$22,947 64	$72,304 69	$43,737 97	$999 62	$139,989 92

STATEMENT OF INCOME.

For the Period July 1, 1924, to September 30, 1924, of the Seventy-sixth Fiscal Year.

License sales:		
Angling, 1924	$57,657 00	
Hunting, 1924-25	23,676 00	
Market fisherman's, 1924-25	17,140 00	
Trapping, 1924-25	128 00	
Wholesale fish packer's and shell fish dealer's, 1924-25	905 00	
Game breeders', 1924	30 00	
Fish breeders', 1924	5 00	
Kelp	10 00	
Total license sales		$99,551 00
Other income:		
Court fines	$11,591 00	
Fish packers' tax	9,177 38	
Fish tag sales	2,502 60	
Game tag sales	28 59	
Interest on bank deposits	295 45	
Total other income		23,595 02
Total income		$123,146 02

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF JULY, AUGUST AND SEPTEMBER, 1924.

Species of Fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Mexican, brought into California via San Pedro	Mexican, brought into California via San Diego
Albacore										138	12,146,536	29,405	4,560,349	16,736,428	217,160	197 479
Anchovies							10 500		289.750	2,000	10,186			312,436		
Barracuda			3				484			14,823	842,570	1,129	361,952	1,220,961	177,221	169,338
Bluefish								245	5,835					6,080		
Boccaccio	10						11,977	15,376	53.384	1,153				81,900		
Bonito								146		2,641	363,338	1,104	40,015	407,244	8,150	443
Carp				216	909	129								1,254		
Catfish		1,785		2,082	37,991	13,058								54,916		
Chilipepper							27.303	553	33					27,889		
Cultus Cod	15.908	5,963					92,832	2,126	14 203					131,032		
Dolphin																
Eels																
Flounders	282						88.121	41	136	3	725			89,308		
Grayfish						4	3,250		824		388		20.017	24,483		
Greenfish																
Hake							27,453							27,453		
Halibut	89,882	7,720	31				1,820	53	4,583	123,181	62,160	136	1,714	321,280	138,811	376,817
Hardhead																
Herring																
Kingfish							1 547	879	5.319		31,614		2,077	41.436		105
Mackerel								29,500	342 943	6.172	305,535	41,237	83,737	809,124	150	48
Marlin																
Mullet													179	179		1,078
Perch	9,429	66	4,670			3	15,372		275		19,907	269	11,385	61,376	350	
Pike				86	12	34								132		
Pompano											1,182		201	1,383		
Rock Bass										51	18,260	6,304	69,029	173 644	105	457
Rockfish	6,586	2 374					200,155	31,684	33,565	7,967	57,155	3,872	166,495	509,873		285
Sablefish	21.100						95,807	3,005		107				120,019		
Salmon	1,723,329	383,511	590	335 652	333,185	1,070,958	1,587,742	134,830	106 845					5,676,642		
Sand dabs							542.455		129		1,266			543,850		
Sardines							368.985	235	41,506,592	310	19,452		545,294	42,440,868		
Sculpin											6,055	18	533	6,606		
Sea Bass—Black										785	9,463	313	11,930	22,491	627	14,499
Sea Bass—White		1,117	14,145				10,308	14,271	2,780	78,630	314,256	776	7,465	443,748	37,263	359,633
Sea Trout																
Shad				10	70	445					482			1,007		

Shad—Buck																
Shad—Roe																
Sheepshead											27	899		85	1,011	
Skates							30,312					82			30,394	
Skipjack								6,248				1,171,179		14,855	1,192 282	315,166	203,406
Smelt	4,850	1,852	2,764				31,799	53,550	44,090	4.191		32,217	23,537	4,061	202,911		1,696
Sole	1,448	21,740					2,305,886	54	11,987	33,265		6,915	1,192		2,382,487	980	370
Splittail																	
Striped Bass				784	339	86,974	25,707		1,279						115,083		
Stingaree																	
Suckers																	
Surf Fish																	
Swordfish												17,296		9,019	26,315		
Tomcod							20,455								20,455		
Trout—Farm																	
Trout—Steelhead	86,784														86,784		
Tuna												314,439	134		314,573	2,244	
Tuna—Bluefin												2,294,538		6,728	2,301,266		
Tuna—Yellowfin												534,477		94,255	623,732	242,052	200,411
Turbot			337												337		
Whitebait	23,702		11				31,691	210							55,614		
Whitefish												3,967		11,260	15,227		875
Yellowtail																	
Miscellaneous	1,820					458	3,199	436	49,933	109 3,369		547,081 26,106	822 277	751 545 1,843	1,299,557 87,441	23,577 297	11,339 195
Total fish	1,985,130	426,128	22,551	338,830	372,506	1,172,063	5,535,160	293,442	42,474,485	278,922		19,269,726	110,545	6,776,023	79,055,511	1,164,153	1,538,474
Crustaceans																	
Crabs	[2]12,840						[4]50,856	[6]216							[7]63,912		
Ecrevisse																	
Shrimps			371,838				217,436								589,274		
Spiny Lobsters																	
Mollusks																	
Abalones									694,850	2,473					697,323		
Clams—Cockle		594	1,034												1,628		
Clams—Mixed	2,385	945	4,476											67	7,873		
Clams—Pismo		659								93,504					94,163		
Clams—Softshell			20,664			23,410	8,295								52,369		
Cuttlefish							1,215	958	16,201						18,374		
Limpets																	
Mussels						30	1,230			242		15,250			16,752		
Oysters—Eastern			[3]52,646				[5]21,318								[8]73,964		
Oysters—Native																	
Snails																	
Squid									1,487,114			565			1,487,679		
Miscellaneous																	
Frogs																	
Terrapins					[9]144										[10]144		
Turtles																	
Totals	[1]2,000,355	428,326	473,209	338,830	372,650	1,195,503	5,835,510	294,616	44,672,650	375,141		19,270,291	125,795	6,776,090	82,158,966	1,164,153	1,538,474

All amounts shown in pounds unless otherwise specified. Albacore and skipjack cleaned.

[1]This report does not include fish taken in Smith River in Sept. [2]535 dozen [3]239,300 shell oysters
[4]2,119 dozen [5]96,900 shell oysters [6]9 dozen [7]2,663 dozen [8]336,200 shell oysters [9]6 dozen
[10]6 dozen

35981 1-25 7500

PATROL SERVICE.

SAN FRANCISCO DIVISION.

G. H. Anderson, Commissioner in Charge. J. S. Hunter, Assistant Executive Officer.

Phone Sutter 6100.

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M. J. Connell, Commissioner in Charge.

Edwin L. Hedderly, Assistant.

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CALIFORNIA STATE PRINTING OFFICE
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SACRAMENTO, 1925

1921 ABSTRACT SPORTING FISH AND GAME LAWS 1923

OPEN SEASON INCLUDES BOTH DATES GIVEN.

SPECIES	DISTRICT	OPEN SEASON	BAG LIMITS POSSESSION LIMITS, ETC.
DEER	1-1½-4½ 23-24-25-26	Sept. 1-Oct. 15	Two Bucks per season. No Does, Fawns, or Spike Bucks. No sale of venison or skins.
	2-2½-3	Aug. 1-Sept. 14	
	4	Sept. 16-Oct. 15	
RABBITS (Cottontail and Bush)	ALL	Nov. 1-Jan. 15	15 per day, 30 per week.
TREE SQUIRRELS	ALL	No Open Season	Closed until Sept. 1, 1925.
ELK, ANTELOPE, MOUNTAIN SHEEP	ALL	No Open Season	Killing Elk a felony.
SEA OTTER, BEAVER	ALL	No Open Season	$1,000 fine for Sea Otter.
BEAR, FUR ANIMALS	ALL	Oct. 15-Feb. 28	
DUCKS, GEESE, JACKSNIPE, MUD HENS	ALL	Oct. 1-Jan. 15	25 per day, except Geese, 8 per day. For weekly limit see law.
RAIL, WOODDUCK, PIGEONS, SHORE BIRDS	ALL	No Open Season	
QUAIL (Valley, Desert, Mountain)	ALL Except 1½	Nov. 1-Jan. 15	Valley, Desert, 15 per day. 30 per week. Mountain, 10 per day. 20 per week.
	1½	Oct. 15-Dec. 15	
SAGE HEN	ALL Except 4½	Aug. 1-Sept. 15	4 per day. 8 per week.
	4½	No Open Season	
DOVE	ALL	Sept. 1-Oct. 31	15 per day. 30 per week.
GROUSE	ALL	Sept. 15-Oct. 14	4 per day. 8 per week.
TROUT (Except Golden), WHITE FISH	1-1½-2-3-4-4½ Lake Almanor	May 1-Oct. 31	See Game Law Abstract.
	2½	July 1-Feb. 14	
	23-24-25	May 30-Oct. 31	
	Lakes, Etc.*	Aug. 1-Oct. 31	
	1½ Winter	Nov. 1-Dec. 31	
	2-3-10 Tidewater	Dec. 15-Feb. 28	
	2-2½-10 Spear	April 1-Jan. 31	
GOLDEN TROUT	ALL	June 30-Oct. 1	20 per day. None under 5 in.
BLACK BASS	All, Except 4e, Clear Lake	May 1-Nov. 30	25 per day. None under 7 in. No sale.
	4e, Clear Lake	No Closed Season	
SACRAMENTO PERCH, SUNFISH, CRAPPIE	ALL	May 1-Nov. 30	25 per day.
STRIPED BASS, SHAD	ALL	No Closed Season	See Game Abstract.
SALMON	ALL Except 15	No Closed Season	See Game Abstract.
	15	April 1-Aug. 31	
CRABS	ALL	Nov. 15-July 30	See Game Abstract.
ABALONES	ALL	Mar. 16-Jan. 14	See Game Abstract.
PISMO CLAMS	17	Sept. 1-April 30	See Game Abstract.
SPINY LOBSTER	ALL	Oct. 15-Feb. 28	See Game Abstract.

*Special provision; see Game Abstract.

HUNTING LICENSES

License Year from July 1 to June 30

Residents, $1.00. Non-residents, $10.00. Certain Aliens, $10.00. Other Aliens, $25.00.

ANGLING LICENSES

License Year from January 1 to December 31

Residents, $1.00. Non-Residents, $3.00. Aliens, $3.00.

TRAPPING LICENSES

License Year from July 1 to June 30

Citizens, $1.00. Aliens, $2.00.